Engineering Library

The Engineer.

JUL 5 1929

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VOL. CXLVII.—No. 3832] LONDON: FRIDAY EVENING, JUNE 21, 1929 [PRICE { WITH SUPPLEMENT } ONE SHILLING BY INLAND POST 1s. 3d.

PUBLIC NOTICES

The Director-General, India Store Department, Belvedere-road, Lambeth, London, S.E. 1, invites TENDERS for :—
20 TANK WAGONS.
Tenders due Tuesday, 9th July, 1929.
Forms of Tender available from the above at a fee of 5s., which will not be returned. 2306

Assistant Civil Engineers REQUIRED in Civil Engineer-in-Chief's Department, Admiralty, and H.M. Naval Establishments at home and abroad. Candidates must be between the ages of twenty five and thirty years on the 20th July, 1929; those who have served, or are serving, in the Army, Navy or Air Force may deduct from their actual age any time, not exceeding three years, during which they have so served. Candidates must either (a) be Corporate Members of the Institution of Civil Engineers or (b) have passed sections A and B of the Associate Membership Examination of the Institution of Civil Engineers, or taken a Degree recognised by the Institution as exempting therefrom, and have reached such a stage in their professional training that it is possible for them to become Corporate Members within two years.
Those appointed will be on probation for two years, and will not be confirmed unless and until they, being Corporate Members of the Institution of Civil Engineers, have passed this period of probation to the satisfaction of the Admiralty.
Commencing salary £250 per annum, plus Civil Service bonus, which at the current rate amounts to £111 per annum.
Special consideration will be given to candidates who served in H.M. Forces during the War.
No candidate will be accepted for appointment who fails to pass a strict medical examination as to his physical fitness.
Forms of application, &c., can be obtained from the CIVIL ENGINEER-IN-CHIEF, Admiralty, London, S.W. 1, and should be returned, completed, so as to reach that officer not later than 20th July, 1929.
Candidates will be responsible for any expenses which they may incur in attending for interview. 2231

Crown Agents for the COLONIES.
COLONIAL GOVERNMENT APPOINTMENTS.
APPLICATIONS from qualified candidates are INVITED for the following POSTS :—
M/1285.—ENGINEERING DRAUGHTSMAN REQUIRED by the GOVERNMENT of NIGERIA for service in the Harbour Department for two tours each of 12 to 18 months' service and possible extension. Salary £510, rising to £800 a year by annual increments. Free quarters and passages and liberal leave on full salary. Candidates, age 25 to 35, must be experienced in the design of Reinforced Concrete Wharves and other Structures.
M/1476.—REQUIRED by the GOVERNMENT of UGANDA, to perform the duties of FACTORIES INSPECTOR under the Public Works Department, a Man, not under 30 years of age, and essentially of strong personality, with thorough all-round practical knowledge and experience of Mechanical Engineering, especially in (a) Steam, Oil and Petrol-driven Plant ordinarily used in factories; (b) Small Electric Lighting Plants; (c) Steam Boilers; (d) General Application of Factories Legislation with special regard to Safety of Workers; (e) general knowledge of Building Construction as applied to Factories. The person engaged will be required to inspect a number of cotton ginneries and other small plant installations of various kinds, and report thereon to the Factories Board, with recommendations for improvement where necessary. Will also be required to act as Secretary to the Board, keeping all records and dealing with all correspondence. Will be required to leave England at an early date and must be able to drive and maintain a motor car. The period of engagement will be for 20 to 30 months' service in the first instance, with possibility of permanency. Salary £600-£30-£720 a year and an outfit allowance of £30 payable on first appointment. Free passages, quarters and liberal leave on full salary.
Apply at once by letter, stating age, whether married or single, and full particulars of qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting the reference number against the appointment for which application is made. 2291

Department of Scientific and Industrial Research.
ENGINEER REQUIRED for Fruit Storage Research Station, East Malling, Kent; age not exceeding 40. Candidates should have a good Honours Degree, with good practical and research experience. Other things being equal, preference will be given to ex-Service men. Scale of salary £350-20-£450 plus Civil Service bonus. Initial pay approximately £485. Superannuation provision will be made under the Federated Superannuation Scheme for Universities.—Further particulars and application forms may be obtained from the SECRETARY, Department of Scientific and Industrial Research, 16, Old Queen-street, S.W. 1, to whom the latter should be returned completed not later than July 6th. 2230

MANCHESTER MUNICIPAL
COLLEGE OF TECHNOLOGY.
(FACULTY OF TECHNOLOGY IN THE UNIVERSITY OF MANCHESTER).
APPOINTMENT OF ASSISTANT LECTURER IN MECHANICAL ENGINEERING.
The Governing Body invites APPLICATIONS for an ASSISTANT LECTURESHIP in MECHANICAL ENGINEERING in the College of Technology.
Salary £300 per annum.
Conditions of appointment and form of application may be obtained from the Registrar, College of Technology, Manchester. The last day for the receipt of applications is Monday, 8th July, 1929.
Canvassing, either directly or indirectly, will disqualify a candidate for appointment.
B. MOUAT JONES,
2262 Principal of the College.

Administrative County of LONDON.
The London County Council will REQUIRE in September, 1929, at the L.C.C. School of Engineering and Navigation, High-street, Poplar, E. 14, a VISITING TEACHER of HEAT ENGINES (Tuesday, 7-9.30), who will be mainly responsible for the Laboratory Work of the Heat Engines Class in the Ordinary Grade National Certificate Course. Fee 16s. for an attendance of about three hours.—Apply, EDUCATION OFFICER (T.1a), the County Hall, Westminster Bridge, S.E. 1 (stamped addressed foolscap envelope necessary), for form, to be returned by 15th July. Canvassing disqualifies.
MONTAGU H. COX,
2240 Clerk of the London County Council.

The Engineer

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PUBLIC NOTICES

Administrative County of LONDON.
The London County Council will REQUIRE in September, 1929, at the L.C.C. School of Engineering and Navigation, High-street, Poplar, E. 14, a FULL-TIME TEACHER for the MARINE ENGINEERING DEPARTMENT. This Department prepares for Board of Trade Examinations for Engineer Officers in the Mercantile Marine. Candidates must possess an Extra First Class Certificate. Teaching experience desirable.
Scale of salary (according to Burnham Award) £290, rising by annual increments of £14 to £410. For graduates £276 by £15 to £528. Commencing salary according to experience. The first increment accrues after two years' teaching experience.
Apply, EDUCATION OFFICER (T.1a), the County Hall, Westminster Bridge, S.E. 1 (stamped addressed foolscap envelope necessary), for form to be returned by 15th July. Canvassing disqualifies.
MONTAGU H. COX,
2239 Clerk of the London County Council.

MANCHESTER MUNICIPAL
COLLEGE OF TECHNOLOGY.
Principal :
B. MOUAT JONES, D.S.O., M.A. (Oxon).
UNIVERSITY OF MANCHESTER.
(FACULTY OF TECHNOLOGY).
DEGREE COURSES IN TECHNOLOGY.
The Prospectus gives particulars of the courses leading to the Manchester University Degrees (B.Sc. Tech., M.Sc. Tech., and Ph.D.), and Certificates in the Faculty of Technology, in the following Departments :—
MECHANICAL ENGINEERING
(Prof. Dempster Smith, M.B.E., M.Sc. Tech., M.I.M.E.).
ELECTRICAL ENGINEERING
(Prof. Miles Walker, M.A., D.Sc., M.I.E.E.).
MUNICIPAL AND SANITARY EYGINEERING
(G. S. Coleman, D.Sc. Eng., A.M. Inst. C.E., A.M. Inst. M. and Cy. E., F.R. San. I.).
APPLIED CHEMISTRY, including General Chemical Technology, Chemistry of Textiles (Bleaching, Dyeing, Printing and Finishing), Paper Manufacture, Metallurgy and Assaying, Chemical Technology of Brewing, Electro-chemistry, Photography, Colouring Matters, Foodstuffs, and Fuels
(Prof. James Kenner, D.Sc., Ph.D., F.R.S.).
TEXTILE TECHNOLOGY
(Professor W. E. Morton, M.Sc. Tech.).
INDUSTRIAL ADMINISTRATION (Post-Graduate Certificate Course)
(J. A. Bowie, M.A., D.Litt.).
Prospectus will be forwarded free on application to the REGISTRAR, College of Technology, Manchester. 2089

PUBLIC NOTICES

University College of South WALES AND MONMOUTHSHIRE.
COLEG PRIFATHROFAOL DEHEUDIR CYMRU A MYNWY.
EXCELSIOR WIRE ROPE CO.'S SCHOLARSHIP OF £50 PER ANNUM.
This Scholarship of £50 a year, tenable for three years by a student who intends to enter some branch of the engineering profession, will be offered for competition at an Examination to be held at the College, which begins on September 16th, 1929.
Every candidate must be a British subject and must have been born in South Wales or Monmouthshire or have been resident there for at least ten years.
The age of the candidates must not exceed 25 years on April 1st, 1929.
Further particulars may be obtained from the undersigned, to whom the form of application must be returned on or before July 31st, 1929.
D. J. A. BROWN,
Registrar.
University College,
Cathays Park, Cardiff.
June, 1929. 2229

University of London.
UNIVERSITY COLLEGE.
An ASSISTANT is REQUIRED in the Mechanical Engineering Laboratory of University College, London, with a First Class Honours Degree in Engineering and a thorough knowledge of workshop practice.
Commencing salary £300 per annum.
Further particulars may be obtained from the undersigned.
C. O. G. DOUIE,
Secretary.
University College, London
(Gower-street, W.C. 1). 2166

Bengal-Nagpur Railway Company, LIMITED.
The Directors are prepared to receive TENDERS for :—
A.—86½ TONS IRON BARS.
B.—TYRED WHEELS.
Specifications and forms of Tender can be obtained at the Company's Offices, 132, Gresham House, Old Broad-street, London, E.C. 2, on or after Thursday, 20th June, 1929.
A fee of 10s. will be charged for each copy of the specification, which is NOT returnable.
Tenders must be submitted not later than Noon on Tuesday, 2nd July, 1929.
The Directors do not bind themselves to accept the lowest or any Tenders, and reserve to themselves the right of reducing or dividing the orders.
By Order of the Board,
R. C. VOLKERS,
2288 Secretary.

PUBLIC NOTICES

Bombay, Baroda and Central INDIA RAILWAY COMPANY.
The Directors are prepared to receive up to Noon on Friday, 12th July, TENDERS for the SUPPLY of :—
MATERIAL FOR BUILDING 15 "YD" CLASS LOCOMOTIVES.
Tenders must be made on forms, copies of which, with specification, can be obtained at these offices on payment of £1 each (which will not be returned).
The Directors do not bind themselves to accept the lowest or any Tender.
S. G. S. YOUNG,
Secretary.
Offices, The White Mansion,
91, Petty France, Westminster, S.W. 1,
19th June, 1929. 2287

Clyde Navigation Trust.
FOUNDATIONS FOR 175-TON ELECTRIC CANTILEVER CRANE AT STOBCROSS QUAY, GLASGOW HARBOUR.
The Trustees of the Clyde Navigation invite TENDERS for the CONSTRUCTION of the FOUNDATIONS for a New 175-Ton Electric Cantilever Crane at Stobcross Quay, Glasgow Harbour. The work comprises the SINKING of STEEL PNEUMATIC CAISSONS, the FORMATION of the CRANE SEAT in CONCRETE, the DRIVING of REINFORCED CONCRETE SHEET PILING and other relative work.
The specification, schedule of quantities and form of Tender can be obtained on application, accompanied by a deposit of £5, to Mr. A. C. Gardner, M. Inst. C.E., Engineer to the Trustees, at this address, where the drawings may be seen. The deposit will be returned on receipt of a bona fide Tender.
Sealed Tenders, marked "Tender for Crane Foundations," are to be lodged with the undersigned not later than Noon on Monday, 8th July, 1929.
The Turstees may not accept the lowest or any Tender.
JAS. MACFARLANE,
General Manager.
15, Robertson-street, Glasgow,
17th June, 1929. 2232

Coventry Corporation.
TENDERS FOR STEEL AND CAST IRON PIPES, VALVES &c.
The Corporation of Coventry are prepared to receive TENDERS for the SUPPLY and DELIVERY at Coventry Station of about 1300 TONS of LAP-WELDED STEEL SOCKET and SPIGOT PIPES of 28in., 21in., and 18in. diameters, and certain CAST IRON PIPES, VALVES and SPECIALS, all of British material and manufacture. Tenderers are at liberty to offer alternative patterns of sockets, but riveted pipes will not be accepted.
Drawings may be seen and specification and form of Tender obtained on and after Monday, the 24th June, 1929, at the offices of Sir Alex. Binnie, Son and Deacon, 30, Buckingham-gate, Westminster, S.W. 1, on payment of a cheque for £5 made out to the Corporation of Coventry, which amount will be returned on receipt of a bona fide Tender.
Sealed Tenders, endorsed "Tender for Steel Pipes, Valves, &c.," should be delivered at my offices at or before Noon on Monday, the 8th July, 1929.
The lowest or any Tender will not necessarily be accepted, nor will any expenses in connection with tendering be defrayed. No Tenders will be considered except from actual manufacturers capable of supplying the pipes and specials within the periods set out in the specification and of completing the whole contract within nine months.
FREDERICK SMITH,
Town Clerk.
The Council House, Coventry. 2237

Nairobi Corporation, Kenya COLONY.
TENDERS are INVITED for the SUPPLY of ABATTOIR PLANT and FITTINGS.
Particulars of requirements and details of local conditions can be obtained from the undersigned not later than Monday, July 8th.
The lowest or any Offer may not be accepted.
CARTERS (MERCHANTS), LTD.
Friars House, 39-41, New Broad-street,
London, E.C. 2. 2281

NORTHERN INDIA
ENGINEERING DEVELOPMENT.
Many huge projects are completed, others are under construction, and still more are under consideration. When tendering, remember that we have handled, inter alia, all the material for the Lloyd Barrage, the largest irrigation scheme in the world, and that WE HAVE THE EXPERIENCE to enable us to quote you the most favourable terms for CLEARING and DESPATCHING up country any quantity of material to any site required.
For full particulars apply, EASTERN EXPRESS CO., Ltd., Karachi; or to Messrs. FORBES, FORBES, CAMPBELL and CO., Ltd. (Managing Agents), 9, King William-street, London, E.C. 4. P 5899

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PUBLIC NOTICES

County Borough of Wallasey.

BATHS AND WASHHOUSES ACT, 1846.
TO ENGINEERING CONTRACTORS.

The Corporation invite TENDERS for the ENGINEERING WORK required at proposed Public Washhouse and Slipper Baths, Oakdale-road, Seacombe.

Plans and specification and form of Tender may be obtained on and after Friday, 21st June, on application at the office of the Borough Engineer and Surveyor, Town Hall, Wallasey, on payment of a deposit of One Guinea, which will be returned on receipt of a bona fide Tender.

Tenders, upon the form supplied, together with all the documents, are to be enclosed in sealed official envelope, endorsed "Tender for Engineering Work, Oakdale-road Washhouse," and are to be delivered to the office of the undersigned not later than Twelve Noon on Wednesday, July 10th, 1929.

The Corporation do not bind themselves to accept the lowest or any Tender.

By Order,
GEO. LIVSEY,
Town Clerk.

Town Hall, Wallasey,
17th June, 1929. 2282

Egyptian Government.

ASWAN DAM.

TENDERS are INVITED by the Ministry of Public Works of the Egyptian Government for the MODIFICATIONS and ADDITIONS to the SLUICE and LOCK GATES in connection with the heightening of the Aswan Dam on the river Nile.

The preliminary specification, drawings and regulations for tendering may be inspected on and after June 26th, 1929, at the offices of the Consulting Engineers, Sir Murdoch MacDonald and Partners, 72, Victoria-street, London, or after July 4th at the Ministry of Public Works, Cairo.

Contractors desiring to Tender may obtain copies of these documents from either of the above offices upon payment of Twenty Egyptian Pounds.

Only Tenders from firms who have previously executed similar works will be considered.

The Tenders must be submitted to His Excellency the MINISTER OF PUBLIC WORKS, Cairo, before mid-day on September 14th, 1929. 2301

Holborn Union, London.

TO BUILDERS AND CONTRACTORS.

The Guardians of the Poor of the Holborn Union invite TENDERS from persons willing to contract for the ERECTION of BALCONIES to the Wards of their Holborn and Finsbury Hospital, Archway-road, N., in accordance with the drawings and specification prepared by their Architect.

The drawings, specification and form of Tender may be obtained from the undersigned at the Guardians' Offices, 53, Clerkenwell-road, E.C. 1, between June 24th and July 17th, 1929, upon depositing £2, which will be returned upon the receipt of a bona fide Tender.

Tenders must be signed, sealed and addressed to the Guardians and delivered at their offices not later than July 17th, 1929, endorsed "Tender for Balconies, Holborn and Finsbury Hospital," and the same will be opened at a meeting of the Guardians on that day. Each person tendering must be prepared to give satisfactory references and sureties if required. The Guardians do not bind themselves to accept the lowest or any Tender.

No contract will be given to firms who do not ordinarily observe the recognised rates of wages and hours of labour.

CHAS. J. CROSS,
Clerk to the Guardians.

Administrative Offices,
53, Clerkenwell-road, E.C. 1,
17th June, 1929. 2303

Skegness Urban District Council.

SEWAGE PUMPING PLANT.

APPLICATIONS from firms of repute who desire to TENDER for the SUPPLY and FIXING of DUPLICATE SETS of FUEL OIL ENGINES and HORIZONTAL UNCHOKEABLE CENTRIFUGAL PUMPS at the Sewage Pumping Station, Skegness, may be sent to Mr. R. H. Jenkins, Engineer and Surveyor, Council Offices, Skegness, not later than Monday, June 24th, 1929.

Specifications, general conditions, and Tender form will be forwarded to approved applicants.

Tenders to be delivered in sealed envelopes, endorsed "Pumping Plant," to the undersigned not later than Monday, July 1st, 1929.

IVOR M. CULE,
Clerk to the Council.

Council Offices,
Ida-road, Skegness,
June 12th, 1929. 2236

Slough Urban District Council.

WATERWORKS.

TENDERS are INVITED for the SINKING, LINING, and TESTING of a 36in. diameter BORE HOLE at Datchet, Bucks.

Particulars can be obtained from the undersigned (on payment of £1 1s. deposit), and Tenders, endorsed "Bore-hole," must be delivered on or before Noon on Friday, the 28th June, 1929.

ALAN BROMLY,
Water Engineer.

Slough, 15th June, 1929. 2245

South Indian Railway Company, Limited.

The Directors are prepared to receive TENDERS for the SUPPLY of :—

1. STEEL TYRES.
2. COPPER PLATES.
3. HELICAL SPRINGS.

Specifications and forms of Tender will be available at the Company's Office, 91, Petty France, Westminster, S.W. 1.

Tenders, addressed to the Chairman and Directors of the South Indian Railway Company, Limited, marked "Tender for Steel Tyres," or as the case may be, with the name of the firm tendering, must be left with the undersigned not later than Twelve Noon on Friday, the 5th July, 1929.

The Directors do not bind themselves to accept the lowest or any Tender.

A charge, which will not be returned, will be made of 10s. for each copy of Specifications Nos. 1 and 2, and of 2s. 6d. for each copy of the Specification No. 3.

Copies of the drawings may be obtained at the offices of the Company's Consulting Engineers, Messrs. Robert White and Partners, 3, Victoria-street, Westminster, S.W. 1.

A. MUIRHEAD,
Managing Director.

91, Petty France, Westminster, S.W. 1,
19th June, 1929. 2290

State Electricity Commission

OF VICTORIA, AUSTRALIA,
22-32, WILLIAM-STREET, MELBOURNE,
AUSTRALIA.

TENDERS are hereby INVITED for the MANUFACTURE, TESTING, SUPPLY, DELIVERY, COMPLETE ERECTION, PUTTING INTO SERVICE, &c., and MAINTENANCE of a complete COAL CONVEYANCING PLANT, in accordance with Specification No. 29/68, to co-ordinate with the existing Coal-handling Equipment, and to include the following main component parts :—

FOUR TRANSFER HOPPERS,
TWO APRON CONVEYORS,
TWO BELT CONVEYORS,
ONE AUTOMATIC TRIPPER.

Copies of Tender forms, specification, drawings, &c., will be available upon application to the Agent-General for Victoria, Victoria House, The Strand, London, England.

Charge £2 2s. for set of two copies complete, returnable under certain conditions as specified in the general conditions of tendering. Extra copies £1 1s. each, not returnable.

Tenders, on prescribed form, properly endorsed and addressed, must be delivered to the undersigned in Melbourne not later than 30th September, 1929.

A preliminary deposit of £50 shall be lodged with Tender.

The Commission does not bind itself to accept the lowest or any Tender.

W. J. PRICE,
Secretary.

2274

PUBLIC NOTICES

City of Liverpool.

JUNIOR STRUCTURAL DRAUGHTSMAN FOR CITY BUILDING SURVEYOR'S DEPARTMENT.

The Health Committee of the Corporation of Liverpool invite APPLICATIONS for the POST of JUNIOR STRUCTURAL DRAUGHTSMAN in the City Building Surveyor's Office. The duties will comprise the examination and checking of structural steel work, details and calculations, and candidates must have had good technical training and drawing-office experience.

Salary will be at the rate of £215 per annum, rising by annual increments of £15 to £260 per annum.

The person appointed will be required to contribute to the Corporation Superannuation Fund. Applications, stating age (which must not exceed 25 years), experience, and qualifications, together with copies of not more than three testimonials, are to be sent to the Town Clerk, Municipal Buildings, Dale-street, Liverpool, on or before Twenty-ninth June, 1929, endorsed "Structural Draughtsman."

Canvassing of the members of the City Council will be regarded as a disqualification.

WALTER MOON,
Town Clerk.

Town Clerk's Office, Liverpool,
17th June, 1929. 2259

City of Liverpool.

CITY ENGINEER'S DEPARTMENT.
RESIDENT ENGINEER—SEA WALL AND EMBANKMENT SCHEME.

APPLICATIONS are INVITED for the POSITION of RESIDENT ENGINEER under the City Engineer in connection with the above scheme.

The appointment will be a temporary one, lasting about two years.

Applicants must have had considerable experience in the construction of this class of work and should state clearly in their applications the various works of this type carried out under their supervision.

Applications, stating age, experience and qualifications, accompanied by copies of not more than three testimonials, to be forwarded through the post, addressed to the undersigned, endorsed "Resident Engineer," so as to arrive not later than the first post on Tuesday, the 9th July, 1929.

Salary £750 per annum.

The appointment will be subject to one month's notice on either side.

Canvassing, directly or indirectly, will be deemed a disqualification.

WALTER MOON,
Town Clerk.

Municipal Offices,
14th June, 1929. 2286

Egyptian Government.

EGYPTIAN MINISTRY OF EDUCATION.

APPLICATIONS are INVITED for the following POSTS, which will become vacant in the Royal School of Engineering, Giza, Cairo, in September, 1929 :—

1. PROFESSOR of MUNICIPAL ENGINEERING and TOWN PLANNING.
2. PROFESSOR of RAILWAY and ROAD ENGINEERING.

Applicants should have a University or other Engineering Degree and good practical experience. Experience in teaching will be considered a recommendation.

The salary offered is £E1200 a year (about £1230), and the appointment will be on contract for three years and will be renewable at the end of that time.

Applications should be sent to the DIRECTOR, Egyptian Education Office, 39, Victoria-street, London, S.W. 1, so as to be received not later than July 15th, 1929. 2199

Municipality of Singapore,

STRAITS SETTLEMENTS.
MUNICIPAL ENGINEER'S DEPARTMENT.
ASSISTANT ENGINEER.

The Municipal Commissioners of Singapore REQUIRE an ASSISTANT ENGINEER for the permanent staff of their Municipal Engineer's Department, the appointment being in the first instance on a three years' agreement.

Candidates should be between 23 and 27 years of age and unmarried. Applicants must have had a good general education and must have completed a term of pupilship or apprenticeship to a Chartered Civil Engineer. Candidates must have passed the Associate Membership Examination of the Institution of Civil Engineers and should have had two or three years' experience in a Municipal Engineer's Office or on such works as are carried out by a Municipal Engineer. Experience in road construction is desirable.

The selected candidate must pass a strict medical examination as to his fitness for service in the Tropics.

Salary, 5280 dollars, 5760 dollars and 6240 dollars per annum respectively for the three years of the agreement, and rising thereafter (if service be continued) to a maximum of 9600 dollars per annum. The exchange value of the dollar is 2s. 4d. sterling, at which rate the salary for the first year would amount to £616. There is at present no income tax.

Free passage will be provided, with half salary during the voyage out.

An allowance for transport on duty will be granted.

Eight months' leave, with full pay, is normally granted after four years' service. Liberal Provident Fund.

Applications, stating whether married or single and giving age and birthplace with details of education, training and experience, and referring particularly to the qualifications mentioned above, and accompanied by copies (not originals) of testimonials, to be lodged with Messrs. PEIRCE and WILLIAMS, MM. Inst. C.E., 64, Victoria-street, London, S.W. 1, Agents to the Commissioners, not later than Monday, 1st July, 1929.

Further particulars, if desired, can be obtained from the Agents. 2275

SITUATIONS OPEN

COPIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED.

WANTED, a MAN with Furnace Experience, Gas Oil and Solid Fuels, to initiate Inquiries and obtain orders. Good prospects for an engineer with sound technical training; must be a salesman. State age, experience, with references, and salary required.—Address, 2271, The Engineer Office. 2271 A

WANTED, ASSISTANT SUPERINTENDENT for large works engaged on light mass production. Successful executive experience as well as a good practical knowledge of tools and methods necessary.—Address, 2182, The Engineer Office. 2182 A

WANTED, to Sail in September for a First-class Structural and Bridge-building Works in India, a qualified ASSISTANT WORKS MANAGER, age about 30. Salary to commence at equivalent of approximately £750 a year, with excellent prospects of advancement; must have had previous experience in similar capacity. Agreement for five years.—Write with copy of photograph and full particulars to Z.S. 490, c.o. Deacon's Advertising Agency, Fenchurch-avenue, London. 2292 A

SITUATIONS OPEN (continued)

WANTED, an Experienced BOILER DESIGNER and ENGINEER, with technical education.—Address, 2225, The Engineer Office. 2225 A

ASSISTANT MANAGER WANTED for Shipyard and Engineering Works in China. Age about 40. One who has been trained as a technical and practical engineer with knowledge of Shipbuilding, also Ship and Engine Repairs. One who is energetic and has already held a responsible or similar position preferred.—Address, stating age, detailing experience and qualifications, also salary expected, P5882, The Engineer Office. P5882 A

BRITISH ENGINEERING COMPANY, with Rapidly developing Continental Trade, has POSITION VACANT for ORGANISER of Continental agents. Must speak French and German fluently, be Englishman of good education and address, and capable of dealing with technical subjects in foreign countries.—Address, stating qualifications and salary required, P5925, The Engineer Office. P5925 A

COMPETENT and Experienced MANAGER REQUIRED for Constructional Yard working in conjunction with North-East Coast Steel Works. Must be accustomed to Design, Fabrication and Erection.—Box N.E. 54, c.o. Advertisement Dept., 5, New Bridge-street, London, E.C. 4. 2243 A

GENERAL ASSISTANT ENGINEER REQUIRED at Waterworks near London; applicant should have had previous Waterworks Experience and preferably be an Associated Member of I.C.E.—Address, stating age, experience, &c., 2298, The Engineer Office. 2298 A

MANAGER (London) WANTED IMMEDIATELY. About 30; intelligent, quick, healthy, energetic, good address and education (preferably University) thorough, ambitious.

Practical and theoretical knowledge Steam, Internal Combustion, Electricity and Workshop Practice.

Commercial routine and SALESMANSHIP.

Good salary, brilliant prospects for exceptional man; none others need apply.

Address,
P5933, The Engineer Office. P5933 A

REQUIRED for Important British-owned Railway in Argentina, CIVIL ENGINEERS, preferably with Railway experience; to be well up in surveying, levelling and taking off quantities. Age 27-32. Salary on three years' agreement £450, rising to £550 per annum, with extra £50 on qualifying in Spanish. Free passage.—Reply, stating age, if single or married, education, training, and full details experience, with copies (only) of testimonials, to Box W.E.T., c/o Davies and Co., 95, Bishopsgate, E.C. 2. 2233 A

REINFORCED CONCRETE CONTRACTORS (Midlands) REQUIRE Energetic ENGINEER of experience to Supervise Contracts in various parts of the country. The job entails much travelling, and suitable applicant must be able to get work done at competitive rates.—Address, giving particulars of experience and salary required, 2252, The Engineer Office. 2252 A

REQUIRED, First-class TOOL MAKER; Must be accustomed to accurate Jig and Tool Work and capable of Designing Jigs and Fixtures for Drill and Machine Work. Successful applicants will be required to work at machine and bench to begin with.—Apply, in first instance by letter only, stating age, past experience, and wages required, to EMSCO ENGINEERING COMPANY, Ltd., St. Albans, Herts. 2257 A

REQUIRED, REPRESENTATIVE for the Sale of High-grade Steels in London and Home Counties; must be thoroughly technical and have first-class connection. The position is an important one, and only those who are thoroughly efficient can be considered.—Reply by letter only, giving full details of experience, to SECRETARY, Quality Steels, Ltd., 70, Pall Mall, London, S.W. 1. 2268 A

REQUIRED, YOUNG MAN, Age 25-28, to Take Charge of new business in India, under supervision of old-established firm. Public School education and preferably knowledge of Engineering and Chemistry. Salary in proportion to age and experience.—Address, 2255, The Engineer Office. 2255 A

SALES MANAGER REQUIRED, with Experience in Centrifugal Pumps for Waterworks Plant and other purposes.—Address, giving full particulars of qualifications, experience, and salary required, P5916, The Engineer Office. P5916 A

SOUTHERN MANUFACTURERS, with Range of presses for blanking and forming up to 3-8 thick mild steel and draw press work up to 36in. blank, with sheet metal workers and oxy-acetylene welders, REQUIRE good-class TRAVELLER for this class of work on salary and commission. Full particulars, age, experience, salary and commission required.—Address, 2280, The Engineer Office. 2280 A

THE POST of ENGINEER at a Large Factory in Argentina, owned by British Company and in good climatic conditions, is VACANT, and APPLICATIONS which will be treated in confidence, are INVITED from Engineers possessing the following qualifications :—

Firstly, highest grade all-round technical training, including the Degree of B.E., B.Sc., or the equivalent thereof, in one of the leading Institutions.

Secondly, practical experience in the working of Steam Plant, including Water-tube Boilers, Steam Turbines, and especially Industrial Evaporating and Condensing Plant, Electrical Machinery (direct current), General Mechanical Engineering, Process Working and Factory Routine. An essential condition would be the acquisition of an adequate knowledge of Spanish within a definite period after taking up the appointment. Salary £800 to £1200, according to qualifications. Good prospect of promotion to a higher position for the right man.

Applications, stating age, which should not exceed 35, and qualifications, with copies of testimonials, in writing to "L. H.," c/o Street's, 6, Gracechurch-street, E.C. 3. 2289 A

TIME STUDY.—First-class MAN, with a Sound Experience of Fixing Piecework Prices from drawings for machine shops making small electrical parts. State age, experience and approximate salary required.—Address, 2297, The Engineer Office. 2297 A

TO STRUCTURAL AND CIVIL ENGINEERS.—Manufacturers of Building Materials to Architects', Engineers', and Public Authorities' Specifications, and who have large existing London connection, REQUIRE First-class LONDON REPRESENTATIVE. Applicants must have had previous experience with good salary in a similar capacity, and connection, and must be accustomed to settling of large contracts. Age 30 to 40. Knowledge of Structural Details desirable.—Address, with particulars, particulars of connection, experience, references, and salary required, P5926, The Engineer Office. P5926 A

SITUATIONS OPEN (continued)

TRAVELLER WANTED for Lancashire and Yorkshire by Manchester Firm of Engineers for Pumps, Valves and Mill Furnishing; must be practical man. State age and salary expected.—Address, 2175, The Engineer Office. 2175 A

TRAVELLER WANTED for London District, on salary and commission, to represent firm making Acetylene Welding and Cutting Apparatus. Man with experience in the Acetylene Industry preferred.—Apply by letter, stating experience and salary required, C. S. MILNE and CO., Ltd., Harley Works, Deptford, S.E. 8. 2247 A

WORKS MANAGER REQUIRED for a British Firm of Engineers in India with Foundry, Machine Smithy, Structural Steelwork and Bridge Depts. Applicants must have had a good general Engineering Experience, possess initiative and organising ability. Age 30 to 35, bachelor preferred.—Write, with full particulars of experience, salary required, to Z.F. 523, c.o. Deacon's Advertising Agency, Fenchurch-avenue, London. 2293 A

WORKS MANAGER WANTED, with All-round General Engineering Experience and knowledge of Light and Heavy Hydraulic and Mechanical Pressed Steel Work.—Apply by letter only in first instance, giving age and full details of previous experience and salary expected, to GENERAL MANAGER, Joseph Sankey and Sons, Ltd., Hadley Castle Works, Wellington, Shropshire. 2277 A

WANTED, Capable DRAUGHTSMAN, London, with general experience, including Petrol Motor and Chassis Work. State qualifications, age, and salary required.—Address, 2246, The Engineer Office. 2246 A

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WANTED, Experienced MARINE ENGINE DRAUGHTSMEN, accustomed to Machinery and Pipe Arrangements for High-class Vessels; also good BOILER DRAUGHTSMAN. West Coast district. Good salary and prospects for first-class men.—Address, 2160, The Engineer Office. 2160 A

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A FEW SENIOR and JUNIOR DRAUGHTSMEN REQUIRED at Derby Works, with good technical training and preferably with experience in Boiler-house or Coal-handling Equipment. State age, salary required, and when at liberty.—COMBUSTION ENGINEERING, Ltd., Rugby. 2261 A

ASSISTANT JIG and TOOL DRAUGHTSMAN REQUIRED by Engineering Firm manufacturing Road Rollers, &c. Applicant must have good experience in Machining and modern methods of production. State age, experience and salary required.—Address, 2272, The Engineer Office. 2272 A

CHIEF DRAUGHTSMAN REQUIRED to Take Charge of Drawing-office, with firm manufacturing Aerial Ropeways in Scotland; salary £7 10s. per week; good prospects.—Address, 2265, The Engineer Office. 2265 A

CHIEF DRAUGHTSMAN REQUIRED IMMEDIATELY by company in West of England manufacturing small speciality machines. State age, experience and salary required.—Address, 2278, The Engineer Office. 2278 A

EXPERIENCED DRAUGHTSMEN REQUIRED IMMEDIATELY by company in West of England, manufacturing small speciality machines. State age, experience, and salary required.—Address, 2279, The Engineer Office. 2279 A

DRAUGHTSMAN, Mechanical, with Experience of Power Transformers preferred.—Apply, stating age, experience, and salary required, to MANAGER, Drawing-offices, B.T.H. Co., Ltd., Rugby. 2106 A

DRAUGHTSMAN, Mechanical-electrical, with General experience of Electrical Apparatus.—Address, stating age, experience, and salary required, 2107, The Engineer Office. 2107 A

DRAUGHTSMAN REQUIRED, Accustomed to Designing Steel-framed Buildings and Constructional Steelwork generally.—Apply, stating salary required, to COCKSEDGE and CO., Ltd., Eagle Works, Ipswich. P5932 A

DRAUGHTSMAN REQUIRED in London Constructional Engineer's Office.—Address, giving full experience, age and salary required, P5934, The Engineer Office. P5434 A

DRAUGHTSMAN REQUIRED in London Office of Firm of Engineers, Draughtsman with knowledge of Conveying and Mechanical Handling Plants. Experienced men only need apply, stating age experience, and salary.—Address, 2269, The Engineer Office. 2269 A

DRAUGHTSMEN.—THE BRITISH THOMSON-HOUSTON CO., Ltd., Rugby, has VACANCIES for MECHANICAL and ELECTRICAL DRAUGHTSMEN.—Apply, stating age, experience, and salary required, to MANAGER, Drawing-offices, B.T.H. Co., Ltd., Rugby. 2183 A

DRAUGHTSMAN, with Sound Experience in Mechanical and Structural Work, Croydon district.—Address, stating age, experience and salary required, 2266, The Engineer Office. 2266 A

EXPERIENCED ENGINEER DRAUGHTSMAN, preferably with knowledge of practical Laundry Engineering. State age, experience, and salary required.—ISAAC BRAITHWAITE and SON, ENGINEERS, Ltd., Ibis Works, Kendal. 2249 A

EXPERIENCED JIG, TOOL and PLANT DRAUGHTSMEN REQUIRED IMMEDIATELY.—Apply, PLANNING ENGINEER, B.T.H. Co., Ltd., Rugby. 2284 A

EXPERIENCED LADY TRACER REQUIRED.—Apply by letter to CHASSIS DRAWING-OFFICE, the Austin Motor Co., Ltd., Longbridge, stating age, experience, and salary required. 2263 A

INDIA.—REQUIRED by British Firm of Engineers, DRAUGHTSMAN, accustomed to Roof, Bridge and Structural Steelwork, able to Work Out Stresses and Prepare Designs, Estimates and Detail Drawings; must be a bachelor, age 22 to 25.—Write, stating age and particulars of experience, to Z.Z. 473, care Deacon's Advertising Agency, Fenchurch-avenue, London, E.C. 3. 2296 A

JIG and TOOL DRAUGHTSMAN, Used to Heavy Motor Lorry Industry, for works in the Midlands. State age, experience and salary required.—Address, 2308, The Engineer Office. 2308 A

JUNIOR MECHANICAL ENGINEERING DRAUGHTSMAN, with previous D.O. experience, REQUIRED AT ONCE for London Office; practical and theoretical knowledge essential; age 21-23.—Address, stating experience and salary required, 2302, The Engineer Office. 2302 A

REQD. for London District, DRAUGHTSMAN, with tech. know. of Fan Design, particularly relating to Induced and Forced Draught Installations in connection with up-to-date Steam-raising Plant. Prog. position to suitable applicant. Reply, giving full partics. in confidence and salary reqd.—Address, 2253, The Engineer Office. 2253 A

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AS SUPPLIED TO THE ADMIRALTY, WAR OFFICE, AND OTHER GOVERNMENT DEPARTMENTS.

ATLANTIC ENGINE CO., WISHAW, SCOTLAND. Dept. "E."

For continuation of Small Advertisements see page 4.

A Seven-Day Journal

Ten Years Ago.

TO-DAY—Friday—is the tenth anniversary of the sinking of the German High Sea Fleet at Scapa Flow, the harbour to which, following its surrender in November, 1918, it had been conducted for internment, pending the peace negotiations. The senior German officer in charge, Vice-Admiral von Reuter, had been secretly instructed from Berlin that his vessels were to be scuttled in the event of the Versailles Treaty being signed. In the forenoon of June 21st, 1919, the British squadrons at Scapa put to sea under Vice-Admiral Sir Sidney Fremantle for exercises. Their departure gave the German admiral his opportunity. A general signal in code, agreed upon beforehand, was made from his flagship, and a few minutes later the Kingston valves, torpedo tubes, and other submerged vents had been opened in all ships. The British guard boats did not realise what was happening until they noticed the German ships heeling over and their crews taking to the boats. Thanks to prompt measures by British boarding parties, the new battleship "Baden," with several cruisers and destroyers, were beached in time to save them, but the major part of the interned fleet went down in deep water. Among those lost were ten battleships, five battle-cruisers, five light cruisers, and many destroyers. Vice-Admiral von Reuter was criticised at the time for what was generally regarded as a breach of faith. It has, however, been made clear that he was acting under strict orders from his Government, and was only the instrument of their policy. As a penalty for the scuttling of the fleet, Germany was required to hand over to the Allies practically all her remaining modern warships, together with floating docks and other equipment. A few years ago a British firm, Cox and Danks, Ltd., began salvage operations at Scapa. Up to the present two battle-cruisers, "Moltke" and "Seydlitz," and most, if not all, of the sunken destroyers have been raised and towed away to be broken up.

European Trade Agreements.

A MOVEMENT that may affect the interests of British manufacturers is in progress on the Continent for the grouping of nations into commercial and industrial unions. The raising of almost insuperable fiscal barriers has had the inevitable result of impeding foreign trade at a time when production has increased more rapidly than the consumption, and when countries which are essentially producers find markets being closed to them. The new United States Tariff Bill has awakened all continental countries to the seriousness of the situation. During the past week the representatives of Italy and Spain discussed in Madrid the conditions of a proposed commercial and industrial agreement, which, coming after the Petite Entente treaty, may possibly serve as a basis for other similar arrangements. The Italian journals clearly indicate the general scheme, which aims at co-operation between producing and consuming countries. Italy has great manufacturing industries, and is practically devoid of raw material. Spain has the raw material which Italy needs, and, while the Government of the Peninsula is making considerable efforts to develop industries, it will obviously take a very long time for that country to be in a position to supply its own requirements in manufactured goods. Why, then, say the Italians, should not Spain supply Italy with raw material and produce, while that country will send to Spain all the machinery and other manufactured goods she needs? These negotiations have awakened much interest in France, where, probably as a means of allaying apprehension, it is suggested that the scheme may be extended, so that eventually one general agreement for an interchange of goods may serve as a basis for the constitution of a United States of Europe.

A James Young Memorial.

ON Friday last, June 14th, an interesting ceremony took place at the Bussey coal distillation plant at Glenboig, Lanarkshire, when a memorial tablet commemorating the work done by the late Dr. James Young, of Glasgow, on the production of oil from coal and shale was unveiled. Sir David Mason, the Lord Provost of Glasgow, presided over the ceremony on behalf of the scientists and public men who had formulated and carried through the memorial scheme. It is of interest to record the fact that no fewer than twenty-five direct descendants of Dr. Young were present. The actual unveiling ceremony was performed by Mr. H. Moubray Cadell, of the Royal Society of Edinburgh, and the Rev. E. Sherwood Gunson conducted the dedication service, while an account of Dr. Young's life and work was given by Dr. P. F. Gordon, of the Royal Technical College, Glasgow. Dr. James Young was the son of a working joiner and was born in the Drygate, Glasgow, in 1811. He attended evening classes and became assistant to Thomas Graham at Anderson's College, and moved with Mr. Graham to University College, London. In 1850 he took out his first patent for the low-temperature distillation of coal, and was successful in developing oil extraction processes which were adopted not only in the Scottish oil industry, but in America and all parts of the world. His technique of oil refinery was used both for the production of paraffin and later for petrol and the lighter fractions. In 1870 Dr. Young endowed the Young Chair of Technical Chemistry at Anderson's College, which institution was later incorporated in the Glasgow and West of Scotland Technical College, of which Dr. Young was President from 1868 to 1877. He became a Fellow of the Royal Society of London, and, honoured by his own College and University, was regarded as one of the great scientists of the Victorian period.

The Pinkston Power Station.

IN a journal note published in our issue of June 7th we referred to the application of the Glasgow Corporation to extend the tramways electric generating station at Pinkston, and the refusal by the Electricity Commissioners to grant the powers sought in that application. The Commissioners, after an inquiry, decided that no case for the extension had been made out, and that the Corporation should take any new supplies required from the Dalmarnock Station or other sources available under the Electricity Supply Acts. Last week the Sub-Committee on Works and Stores of the Glasgow Corporation Tramways Undertaking decided to recommend that tenders be invited for the reconditioning of the present plant in the Pinkston Power Station, at an estimated cost of about £200,000. The opinion was expressed at the meeting of the Committee that the Electricity Commissioners had no power to prevent the department from reconditioning the existing plant as long as no extensions were made. The scheme has to come before the main committee for its approval. If approved it is understood that the capital cost can be repaid in ten years by savings in depreciation and economies in coal consumption. In the scheme which formed the subject of the recent inquiry, a total expenditure of £237,000 was proposed, of which about two-thirds would have been spent on reconditioning the existing plant and the remainder in installing a spare turbo-generator set to meet the increased power requirements of the Glasgow Tramways Department.

Sir Felix Pole's New Appointment.

THE announcement is made that Sir Felix Pole, the present general manager of the Great Western Railway Company, has accepted the post of chairman of the recently constituted firm, Associated Electrical Industries, Ltd. This company, it will be remembered, is a holding company, with a capital of over 4¾ million pounds, controlling the British Thomson-Houston Company, Ltd., the Metropolitan-Vickers Electrical Company, Ltd., the Metropolitan-Vickers Electrical Export Company, Ltd., Edison and Swan, Ltd., and Ferguson Pailin, Ltd. A substantial interest in the new company is also held by the International General Electric Company of New York. Sir Felix Pole, when released from his railway duties, will take the place of Mr. Howard C. Levis, who has resigned. Sir Felix is comparatively young, being only fifty-two years of age, and has had a remarkable career. He joined the Great Western Railway Company as a telegraph clerk at Swindon at the age of fourteen, after which he passed successively to Port Talbot, Truro, and to the electrical department at Paddington. For several years he was on the staff of the chief engineer and became assistant to the general manager in 1919, a position to which he himself was promoted two years later.

The Death of Two Motoring Pioneers.

IT is with great regret that we have to record the death of Sir Julian Orde, who died on Monday last, June 17th, at his home at Raveningham, Norwich. Sir Julian, who was sixty-eight years of age at the time of his death, will be long remembered by the work he did during the twenty years he was the secretary of the Royal Automobile Club. When he became secretary of the Club in 1903, after returning from America, the Club was but six years old. In the years which followed he extended its scope and services, and it was he who organised the great contests such as the International Tourist Trophy Races and the International Touring Car Trials. Such technical matters as brake horse-power rating, side slip and skidding, headlights, and the avoidance of dust, also received the attention of R.A.C. officials, and the Treasury adopted the Club's horse-power rating for the assessment of motor cars for purposes of taxation. He was a member of several Government Committees, and associated himself with various transport organisations. In recognition of his many services Sir Julian was knighted in 1919. He retired from the secretaryship of the Royal Automobile Club in 1923. Automobilism has also lost recently another notable pioneer in the person of Dr. Blackwood Murray, who died on June 11th at Monthey, Switzerland. Dr. Murray, who was fifty-eight years of age, did much to further the Scottish motor car industry. He was born at Biggar, and was educated at Edinburgh University. After some practical experience with King, Brown and Co., of Edinburgh, and Kennedy and Rankin in Glasgow, he became the manager of Messrs. Mavor and Coulson's electrical installation department. About 1895 Dr. Murray interested himself in electrically propelled cars, but in 1900 he turned his attention to the development of the petrol engine driven vehicle. In that year he formed, along with Mr. Norman O. Fulton, the Albion Motor Car Company, Ltd., which three years later moved from Finnieston, Glasgow, to large new works at Scotstoun. He received the degree of Doctor of Science in Engineering from Edinburgh University in 1917 in recognition of the services he had rendered to the motor industry.

The First Direct Atlantic Flight.

UNDER the chairmanship of Brig.-General Lord Thomson of Cardington, the new Secretary of State for Air, and at the invitation of Vickers (Aviation), Ltd., and Rolls-Royce, Ltd., a company of about 350 assembled at luncheon last Friday at the Savoy Hotel, London, to celebrate the tenth anniversary of the first direct trans-Atlantic flight. At 5.13 p.m., summer time, on June 14th, 1919, Captain J. Alcock and Captain A. Whitten Brown started from St Johns, Newfoundland, on a Vickers "Vimy" biplane, fitted with two Rolls-Royce "Eagle" engines of 360 horse-power each. Sixteen and a quarter hours later they landed at Clifden, County Galway, having flown a distance, measured in a straight line, of 1890 miles. Except for the fact that there was a good following wind, the weather was bad almost throughout the entire flight. Sir John Alcock—he and his navigator were knighted by the King for their deed—was killed six months later in an aeroplane accident, but Sir Whitten Brown is still with us, and was present at last Friday's luncheon. Their aeroplane is now preserved at the Science Museum, South Kensington. A month or so previously the United States flying boat "N.C. 4," had crossed from Trepassy Bay to Lisbon, *via* the Azores, but Alcock and Brown's was the first direct non-stop flight across the Atlantic. The feat remained unrivalled for eight years until Colonel Lindberg in 1927 made his single-handed flight.

Wages in the Engineering Trades.

ON Wednesday, June 19th, the Engineering Employers' Federation considered the application of the engineering trade unions for an increase in the time rate of wages of 8s. per week, with a corresponding increase for piece rate workers. The case for the unions was presented by four spokesmen: Mr. J. T. Brownlie, President of the Amalgamated Engineering Union; Mr. C. Dukes, of the General and Municipal Workers' Union; Mr. J. Hill, of the Boilermakers' Society; and Mr. W. T. Kelly, of the Workers' Union. The principal speaker was Mr. Brownlie, who drew attention to the higher rates of wages paid in the "sheltered" industries. Whereas the wage rates of these trades were before the war equal to those of skilled workers in the engineering industry, the engineering rates were now only 50 per cent. above the 1914 level, compared with 80 per cent. in most of the sheltered trades. Sir Allen Smith, replying for the Engineering Employers' Federation, reviewed briefly the present position in the engineering industry. He referred to the fact that the employers did not feel themselves to be in a position to estimate the obligations which the industry might be called upon to face in the immediate future. He suggested that it would be contrary to the interests of the industry to incur any further obligations at the present stage, and put forward the suggestion that the matter be deferred until the end of the year. The unions suggested, without success, that the proposed adjournment should be for six weeks and not for six months, and after a private meeting decided to report back to their Executive Committees and to call a joint meeting of those bodies for July 25th.

The Channel Aeroplane Disaster.

THE Imperial Airways liner "City of Ottawa," a Handley Page twin-engined machine, which left Croydon on Monday morning for Zurich with eleven passengers on board, met with a mishap when she was some 15 miles across the English Channel. Sending out the "M'aidez" signal, the international aeronautical S.O.S., the pilot turned his machine back towards the English coast. Within 4 miles of Dungeness, however, he found it impossible to proceed further, and was forced to alight on the water within a short distance of a Belgian trawler. The impact severely damaged the machine, and as a result of the mishap seven of the passengers lost their lives. The pilot and mechanic were among those saved. The machine was salved. At the inquest on Wednesday the pilot stated that one of the engines emitted a clanging noise and developed violent vibration. Oil proceeded to pour from it. As the vibration continued, he turned back and endeavoured to regain land. The machine, however, lost altitude continuously, and he decided when between 3 and 4 miles from the shore to alight on the water near a trawler. He glided down at the minimum speed at which he could retain efficient stability. The verdict on the victims whose bodies had been recovered was that they had lost their lives by drowning caused by the accidental fall of the machine into the Channel.

The Cascade Tunnel: Great Northern Railway, U.S.A.

No. II.*

IN the preceding article it was explained that the tunnel is on a straight line with a continuous gradient of 1 in 65 descending from the east portal. Also, that the method of construction provided for a pioneer bore parallel with, and in advance of the main tunnel, but extending only 5·4 miles from the west end to a connection with an intermediate shaft, lateral drifts being driven to the line of the main tunnel so that the latter could be attacked at numerous points. For the 2·4 miles from the shaft to the east end, only the centre heading of the main tunnel was driven.

The centre headings of the tunnel were 10ft. by 10ft. The pioneer bore was 8ft. by 9ft., with its floor at the same elevation as the floor of the main tunnel, so as to provide for drainage. The lateral drifts or cross-cuts were also 8ft. by 9ft., spaced about 1500ft. apart, but closer where it was desirable. They were at an angle of about 45 deg. with the tunnel line. Following the centre headings came the enlargement to full tunnel section, with timber lining where necessary, and finally a concrete lining throughout. The monthly rates of advance required for the scheduled progress were 800ft. for the pioneer bore, 800ft. for the main heading from the west, 500ft. for the main heading from the east end, 500ft. for the main headings each way from the shaft; 115ft. for sinking the shaft, and 900ft. per month for enlarging the headings to full tunnel section.

General Progress.—Construction was begun first at the west end, being started at the west portal of the pioneer tunnel on December 14th, 1925. It soon appeared that bad ground in passing under the Tye River would involve slow work and heavy timbering, thus interfering seriously with the rate of progress scheduled as necessary for completion of the tunnel within the contract time. Work at this point was, therefore, supplemented by starting an inclined drift or adit, 8ft. by 9ft. and about 250ft. long, on the east side of the river, about ¼-mile beyond the portal. This drift ran down to the location of the pioneer bore, which was then started from the end of the drift. Here the work was in good solid rock and progressed rapidly.

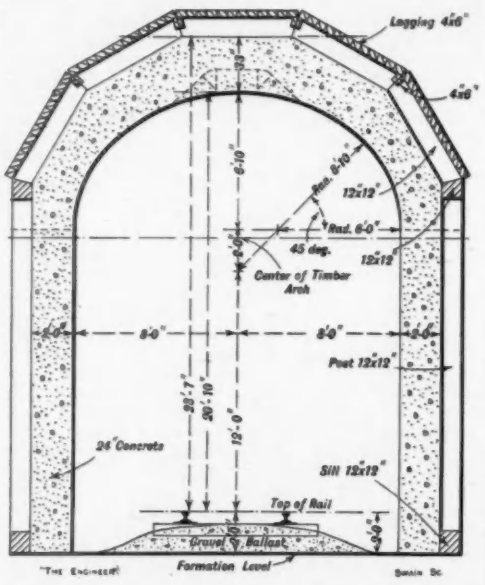

FIG. 10—CROSS SECTION OF TUNNEL AND TIMBERING

In fact, two world records were made in this 8ft. by 9ft. tunnel; with an advance of 937ft. in August and 1157ft. in October, 1926. This heading had reached a distance of 5703ft. from the portal by the time—in September, 1926—the heading from the portal had passed through the bad ground and broken into the bottom of the inclined drift. The highest records in driving the pioneer tunnel, 8ft. by 9ft. were 52ft. in one day, 90ft. in two days, 140ft. in three days, and 1157ft. in one month, while the highest record in enlarging the 10ft. by 10ft. centre heading to full tunnel section was 1220ft. in one month. The nearest records to the above were those made in the Connaught Tunnel of the Canadian Pacific Railway in 1915, where the pioneer bore, 6½ft. by 8ft. was advanced 37ft. in one day, 68ft. in two days, 98ft. in three days, and 932ft. in one month; while the enlargement of the main tunnel heading was advanced 1030ft. in one month.

At the east end, where no pioneer bore was driven, work began December 29th, 1925, on the 10ft. by 10ft. centre heading for the main tunnel. This also was started from a short adit, the purpose in this case being to keep the tunnel work free from that on the approach cutting to the portal. On this heading the crew drove 984ft. in September, 1926.

The Mill Creek shaft was started February 8th, 1926, and by July 15th it was completed to a depth of 659ft., or 32ft. below the level of the tunnel floor. This extra depth was required for storage bins to receive the rock excavated from the tunnel headings and feed it to the hoisting skips in the shaft. This shaft was 8ft. by 24ft., divided into four compartments by timbering. Two compartments were for the hoisting skips, one for the workmen's cage, and the fourth for emergency ladders and the pipes for pumping, ventilating and compressed air supply.

From the shaft the tunnel full section was excavated each way for about 100ft. before starting the 10ft. by 10ft. centre headings, this being done to give room for the rock removed from the headings. The centre headings driven from the shaft and the east portal met on March 4th, 1927. Enlargement of this eastern portion of the tunnel to full size was then begun at the east portal. It progressed rapidly, making a record advance of 1220ft. for the month of August, 1927, and it was completed through to the shaft in May, 1928. In order to keep the supply of materials for the enlargement free from interfering with the trains hauling away the rock, the men, drills, explosives and supplies were handled from the shaft, so that the rock trains had uninterrupted movements between the enlargement work and the portal.

Westward from the shaft a top heading for the main tunnel was driven part of the way on account of bad ground. Beyond this was the usual 10ft. by 10ft. centre heading. A drift was also run south from the shaft to the line of the pioneer tunnel, and this 8ft. by 9ft. bore was started west in October, 1926. On May 1st, 1928, the pioneer headings met, the final blast being fired by President Coolidge, at Washington, who pressed a button on his desk closing an electric circuit to the tunnel. The western crew had driven 15,460ft. from the portal, and the eastern crew had driven 10,535ft. from the shaft.

Meanwhile, work on the main tunnel had been in progress at many intermediate points between the west portal and the shaft, by means of the cross-cuts from the pioneer bore. As soon as these headings had advanced sufficiently, their enlargement to tunnel section was begun. The final meeting of the headings between the shaft and west portal took place on October 20th, 1928. At that time there were in all 6½ miles completed and lined with concrete, and another mile was ready for the concreting.

Rock and Water.—The rock is mainly a granitic formation, which, in general, drilled well and broke up well in blasting. But there were numerous seams of soft and water-bearing material that caused trouble and delay. For about half a mile from the west portal there was loose ground, in soft clay with boulders and gravel seams, sometimes containing much water. This required heavy timber lining. Instead of the centre heading, therefore, a full top heading was used in driving the main tunnel from the west portal to the first cross-cut, so that the roof could be timbered before work was begun on the bench. A typical section of the tunnel with timber lining is shown in Fig. 10.

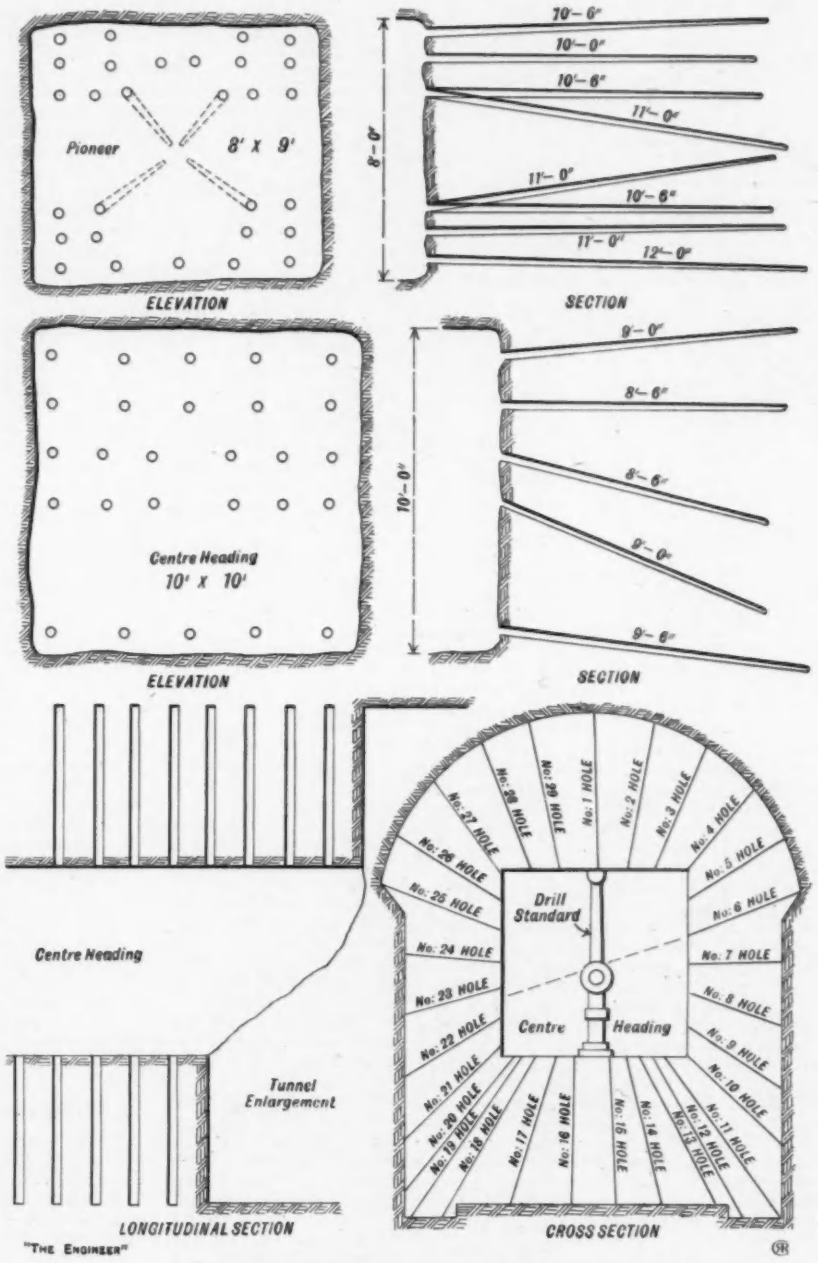

FIG. 11—ARRANGEMENT OF DRILL HOLES IN TUNNEL

Westward from the shaft a top heading for the main tunnel was driven part of the way on account of bad ground. Beyond this was the usual 10ft. by 10ft. centre heading. A drift was also run south from the shaft to the line of the pioneer tunnel, and this 8ft. by 9ft. bore was started west in October, 1926. On May 1st, 1928, the pioneer headings met, the final blast being fired by President Coolidge, at Washington, who pressed a button on his desk closing an electric circuit to the tunnel. The western crew had driven 15,460ft. from the portal, and the eastern crew had driven 10,535ft. from the shaft.

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At the shaft the bottom was in shattered rock, with seams of soft material, so that heavy timbering was required for those portions of the main tunnel which were driven from the shaft. Here, therefore, the top heading system was used, as noted above. As the rock had a tendency to slack and spall when exposed to the air, owing to its lime content, it was given a temporary coating of grout applied by a compressed-air cement-gun to a thickness of ¼in. to ¾in. This was omitted, of course, where timbering was required. Permanent protection is afforded by the heavy concrete lining.

Water was encountered at various times, with some flows of 2500 gallons per minute, so that by May, 1927, there was a total discharge of about 10,000 gallons per minute at the west portal of the pioneer tunnel. By September this had dropped to 6000 gallons, which flow continued almost to the conclusion of the work. At the shaft, a heavy inflow had been expected from the tunnel headings, and in September,

* No. I. appeared June 14th.

1927, the pumps were discharging 2200 gallons per minute at the top of the shaft. After the pioneer tunnel had been completed from the shaft to the west portal it drained all the workings, so that pumping was no longer necessary.

This tunnel forms a permanent drainage channel for the railway tunnel, lateral drains being laid in the cross cuts and through the ballast to divert the water flowing in the side drains along the formation level.

Drilling and Blasting.—In the pioneer tunnel and in all the main tunnel headings, the drilling was done from carriages travelling on a 2ft. line of rails, each carriage having four compressed-air drills of the water-core type. A drill carriage in position at the heading is shown in Fig. 15, page 682. The drill rods were 1¼in. in diameter, hollow, and made of crucible steel. A supply of drill rods was carried from the blacksmith shop, which had a battery of drill-sharpening machines, to the heading on lorries, so arranged that drills of any desired length were at once accessible. Used drills were replaced on the lorry for return to the shop.

At certain points where it was more satisfactory to use a top or bottom heading, the drills were mounted on bars instead of upon carriages. The drill bar was used also in the centre headings of the tunnel east of the shaft, and also in all enlargements of the heading to full tunnel section. In Fig. 11 are shown typical arrangements of drilling for the pioneer bore, the centre heading and the enlargement.

When the drilling of a round neared completion, the powder car was moved up to the rear of the lorry carrying the drills. This car, with a supply of explosives sufficient for one round of blasting, had a locked wooden body lined with india-rubber and having a separate compartment for the primers. While the drill holes were being cleaned out with compressed air, the explosives were carried to the face in boxes. The drilling carriage, drill-rod lorry and powder car were then moved back into a cross-cut for protection, and the electric lighting wires were removed from the face. Blasts were fired by means of the 220-volt lighting circuit.

Work was carried on night and day, in three shifts, and no stops were made for Sundays or holidays. A typical heading operation in the solid rock on the 8ft. by 9ft. pioneer tunnel is given as follows:—Blast, ventilation, 27 minutes; cleaning up rock scattered by the blast, 38 minutes; mucking, 1 hour 22 minutes; removing mucking machine and setting drill carriage in place, 38 minutes; drilling, 1 hour 17 minutes; loading holes and getting men clear before the blast, 18 minutes. This makes a total of 4 hours 40 minutes between blasts. The record was made with twenty-eight holes averaging 8½ft. deep, and loaded with 195 lb. of dynamite. The force totalled sixteen men, and the "muck" or blasted rock filled twenty-eight cars of 50 cubic feet capacity. The advance averaged 7½ft. for each blast. A drilling round in the pioneer bore averaged 313ft. of hole with 265 lb. of dynamite. In the centre heading it averaged 237ft. of drill hole with 251 lb. of dynamite.

In all headings the mucking was done by electrically-operated machines which gathered up the loose rock and loaded it by a conveyor into steel side-tip cars of 50 cubic feet capacity. The conveyor end of one of these machines is shown in Fig. 12, with an electric locomotive attached to the car. These cars were hauled in trains on lines of 2ft. gauge by 6-ton electric locomotives. The double track line in the tunnel was laid so that the inner rails formed a third or middle track on which the drill carriages and mucking machines travelled.

In rear of the mucking machine a train of empties was kept on one track, and, as each loaded car was pulled away, an empty car was swung over on to the loading track by a derrick car or travelling jib crane, humorously designated as a "cherry picker." This method saved much time as compared with shunting the cars. In the enlargement work, air-operated excavators were used for mucking or loading the loose rock. One of these machines, mounted on crawlers instead of wheels, is shown in Fig. 17, page 682, with the timbered tunnel in the background. On the rear of the machine was a "cherry picker" derrick to transfer the empty 6-yard side-tip cars on to the loading track. These larger cars ran on lines of 3ft. gauge, and the trains were handled by 20-ton electric locomotives. Every tunnel engine carried a reel of conductor wire—see Fig. 12—so that it could run 400ft. or 500ft. beyond the end of the trolley line, which was thus kept back far enough to be out of range of damage by the blasts. Some of the engines were also equipped with storage batteries, to enable them to operate if current failed or the wires came down.

Power, Lighting and Ventilation.—Electric current was obtained from transmission lines on each side of the mountain. For emergency purposes, stand-by plants consisting of generators driven by oil engines of 720 and 1200 H.P., were provided at the portals and the shaft, Their value was proved at one time when trees blown down by a storm broke the high-tension transmission lines so that current from that source was interrupted for three days. Motor-driven air compressors comprised five at the west end, four at the shaft and three at the east end. Each had a capacity of 950 cubic feet of free air per minute, and compressed it to a pressure of 110 lb. per square inch. Specially good lighting was provided as an aid to the speed and efficiency of the work.

Machinery motors operated on 2300 volts. For the underground work the power circuits were three-phase 60-cycle 2200 volts, with 220 volts for the lighting circuits. For the electric locomotives 275-volt current was furnished by motor generator sets placed at the portals and at various interior points as the distances became too great for 275-volt direct-current transmission.

Motor-driven fans supplied ventilation for the headings and the completed portions of the tunnel. Thus at the west end a fan installed on the outside delivered a current of 20,000 cubic feet per minute into the pioneer bore, which served as a conduit, the cross-cuts to the main tunnel being closed. At about 2000ft. from the face or heading of the pioneer a cross-cut was left open and the pioneer bore closed, the air current being thus diverted into the centre heading and main tunnel. Another fan with a capacity of 9000 cubic feet per minute was placed in a chamber at the point where the pioneer bore was closed, and this delivered air through a line of 20in. sheet iron pipe to the face of the pioneer heading and two headings of the main tunnel. The pipes were fitted with reversing gates to allow the fan to deliver fresh air or draw out foul air as required.

No artificial means of ventilation is needed for the finished tunnel, since the traffic will be handled entirely by electric locomotives, while its continuous inclination causes a strong upward current of air.

FIG. 12—MUCKING MACHINE LOADING CAR

FIG. 13—CONCRETE PLANT FOR LINING TUNNEL

FIG. 14—CONCRETING PLANT IN TUNNEL

Concrete Lining.—The tunnel is lined throughout with concrete, the minimum thickness specified being 1ft. in solid rock and 2ft. where the rock was loose or of doubtful character. Actually, there is an average thickness of 33in. Where timbering was necessary during contruction, this permanent lining was provided for by setting the posts back to allow for a net thickness of 2ft. of concrete beyond their faces, while the crown of the arch timbering allowed for a 33in. concrete arch beneath it—see Fig. 10. This concreting did not wait for the completion of tunnel excavation, but closely followed the enlargement of the heading to full section at various intermediate points. In fact, it began on October 12th, 1926, a little less than twelve months after the tunnelling was started. The portals are of concrete, of very simple design.

As it would not have been practicable to prepare the concrete at an outside plant and transport it to place, travelling mixer plants were designed. They included supports for the collapsible steel forms and also the necessary equipment for placing the concrete. There were eight of these self-contained concreting plants, typical views of which are shown in Figs. 13 and 14. In Fig. 13 the machine is just outside the east portal. The concrete mixer is in the middle, with the hoists at one side. Beyond is the hopper—in the steel tower—with one of the chuting spouts at the right. In the rear is the steel lattice boom with inclined belt conveyor. The steel forms for the arch are in place. On either side are the concrete walls of the approach. In Fig. 14 the mixer drum is at the left, with tower in the middle carrying the hopper into which concrete is dumped by a skip riding on the inclined rails. At the right of the tower is the pneumatic concrete gun for placing concrete in the roof arch by means of the flexible pipe which appears just beyond the "gun." This view is in a timbered portion of the tunnel. At the extreme right is one of the gravity chutes or troughs for placing concrete in the lower part of the side walls.

The steel-frame traveller or carriage was mounted on rails on each side of the tunnel floor, and all equipment was arranged on a deck high enough to allow the trains of tunnel cars to pass under it and go to and from the heading without interference. On this deck, 9ft. above the rails, were the mixer, hoists, chutes, conveyor and compressed air "gun" for shooting the concrete into place. This gun handled ordinary concrete and is not be to confused with the cement gun already mentioned as used for coating the rock with a protective layer of grout or "gunite." The concrete was proportioned one part of cement to two parts sand, and four parts of washed gravel. Steel forms 37ft. 6in. long, of collapsible design, were mounted on the traveller, which was moved as required by a cable attached to one of the 20-ton tunnel locomotives. This is shown in Fig. 16, page 682. The bottom cross timber, on which a man is standing, is only temporary, being placed as a brace, while the traveller is moving.

Gravel, sand and cement were stored outside each end of the tunnel, and were delivered to batch boxes on platform cars by means of automatic proportioning devices. Gravel was proportioned by volume and sand by weight. Cement was placed in a separate compartment of the batch box, so that it would not come into contact with the wet aggregate until the entire batch was discharged into the drum of the mixer. Two supply trains of 3ft. gauge served each concreting plant, so that one could be loading while the other was delivering material to the mixer. A train consisted of eight platform cars with four batch boxes of ½ cubic yard capacity on each car, making a supply of thirty-two batches. An electric derrick on the traveller swung up each box in turn, dumping its contents into the loading skip of the mixer and replacing it on the car.

For the lower part of the side walls, the concrete was spouted directly into place. For the upper portion it was discharged from the mixer into a skip which carried it to an elevated hopper. From this it flowed on to the lower end of an inclined conveyor belt on a steel boom, 45ft. long, which raised it to the level of the springing line and delivered it to inclined chutes or troughs entering the forms. For the arch, the concrete was fed from the hopper to the chamber of the pneumatic gun, and thence shot into place through 6in. rubber hose, ¾in. thick, with a length of 5ft. to 20ft. Each of these concreting plants could place 16 cubic yards of concrete per hour. The forms were collapsed after about fifteen or twenty hours to allow the traveller to advance 37½ft.

(To be continued.)

Institution of Electrical Engineers.

No. I.

SUMMER MEETING.

A MERRY party left London on Tuesday of last week to take part in the Institution of Electrical Engineers' Summer Meeting in France. Something like 100 names of members and ladies appear on the list of participants. After the first part of the meeting, which was held in Paris, and which terminated on Saturday, June 15th, some of the members returned to their homes, whilst the remainder, accompanied by others who joined the party for the purpose of taking part in the second part of the meeting, proceeded to the Pyrenees. Although up to the time of writing the weather has been a little unsettled, and closeness and rain have been experienced, the participants have suffered no real inconvenience, and the trip has proved highly instructive and enjoyable.

From an engineering point of view, the Paris part of the outing is to be regarded as the most important. Beginning their visits on Wednesday, June 12th, the members inspected two large and impressive power stations of the Compagnie Parisienne de Distribution d'Electricité at Saint Ouen and the Gennevilliers station of the Union d'Electricité. Both of these stations are considerably larger than any in this country, the former, which is the principal station for the supply of Paris, having a capacity of no less than 400,000 kilowatts. The turbine-room is longer than any other we have seen. Economy of space seems to have been a matter of secondary consideration, the generating sets being widely spaced. Apart from its large output, however, the station is not exceptional; in fact, viewed in the light of the latest ideas it is a little out of date. There is no pulverised coal plant and the steam conditions are quite normal; moreover, all the large machines appear to run at 1500 revolutions per minute. The Gennevilliers station,* however, which supplies a large area outside Paris, and which, of course, has been built within comparatively recent years, is more in accord with present ideas; at any rate, some of the boilers are fired with pulverised coal, and the two latest generating sets, which are worked from these boilers, conform pretty well with present-day practice, except in respect of speed. The full load capacity of each of these machines is 45,000 kilowatts, the overload capacity 55,000 kilowatts, the steam pressure at the throttle 325 lb. per square inch, and the total temperature 735 deg. Fah. Without auxiliaries and without bleeding, the steam consumption is 9·13 lb. per kilowatt hour, or 13,700 B.Th.U. per kilowatt hour, whilst with bleeding the consumption is 13,270 B.Th.U. The boiler-house efficiency is 82 per cent., the net heat consumption per kilowatt hour, with all auxiliaries being 17,210 B.Th.U. Like the Saint Ouen station, the Gennevilliers station generates 50 cycle current, but even the latest machines only run at a speed of 1500 revolutions per minute. The impression we were left with after inspecting these two stations was that the capital cost per kilowatt installed must be fairly high, and that economy in this matter does not receive as much attention in France as it does in this country.

Another visit was paid on Wednesday, June 12th, to the new power-house of Electricité de la Seine at Ivry, built mainly to supply the Metropolitan Underground Railway, which was formerly supplied from the stations at the Quai de la Rappe and St. Denis. The present capacity of Ivry is 60,000 kilowatts, but it is capable of being extended up to an ultimate capacity of 130,000 kilowatts. The use of exceptionally high pressures and temperatures has not been resorted to. The boiler pressure is 22 kilos. per square centimetre, or 313 lb. per square inch, and the final temperature of the station 707 deg. Fah. Some of the boilers are fired with pulverised coal; others are fitted with chain grate stokers. Up to the present, four main generating units have been installed, each giving the most economical results at 12,000 kilowatts, but being capable of developing 15,000 kilowatts continuously. Besides the main generating units, there are two 650-kilowatt auxiliary units, which have been placed at the river end of the station, in order to have the other end clear for extensions. Still another visit on Wednesday, June 12th, was one to the million-volt laboratory of the Compagnie Electro-céramique at Ivry.

On this first day of the meeting the ladies were well catered for, but some joined the main parties and viewed the power stations, &c., in preference to inspecting dresses and jewellery. In the afternoon a visit was paid to the Ecole Supérieure d'Electricité, an electrical training school of no small interest. The members were received by Monsieur Paul Janet, member of the Institute of France and Director of the School, which was originally created by the Société des Electriciens out of its own resources, and was situated at 14, rue de Stael. After the war, the number of students greatly increased, and the old building became inadequate. A new school, to which French industry subscribed seven million francs, the State four millions, the Paris Municipality two millions, and the department of the Seine 650,000f., was therefore built. The building was completed on November 10th, 1927. Provided they possess the necessary qualifications, the school is open to students of all nationalities. The training, which extends over a period of one year, consists of two courses of forty and sixty lectures, delivered by University-trained teachers, who have kept in constant touch with the electrical industry, and a large number of lectures on applied electro-technics by men who are actually engaged in the class of work upon which they lecture. Besides this training, the school devotes attention to practical work, which consists of measurements, test-bed work, workshop practice, and high-tension work. The laboratories and workshops are excellently equipped, and the general conditions under which the students work are admirable in every way. In the evening there was a banquet at the Hotel Continental, Paris, given by the Société Française des Electriciens, the Compagnie Parisienne de Distribution d'Electricité, and the distributing authorities of the Paris suburbs.

Thursday, June 13th, was devoted mainly to a visit to the wireless station of Saint Assise, situated on the right bank of the Seine between Corbeil and Melun, about 40 kiloms. from Paris, and standing on the ancient domain of St. Assise. The establishment consists of several transmitting stations—the continental station connecting France with several European countries, and the Near East—and a valve set which ensures connection between London and Paris; the trans-oceanic station for communication between Europe and the continents, and comprising long-wave transmission sets, consisting of high-frequency alternators of 250 and 500 kilowatts capacity. Associated with this installation are short-wave valve transmitters for maintaining the traffic at all times under the best conditions. At the reception centre at Villecresnes, half-way between Paris and St. Assise, there are frame aerial stations and frame and open aerial stations combined, equipped with anti-parasitic and selective receivers, all messages received being recorded at the Paris central office. On the technical side the company which owns the stations has kept well abreast of the times, as is exemplified by the addition of the short-wave transmitters, which have proved more economical and more satisfactory than the long-wave equipment.

(To be continued.)

* See THE ENGINEER, July 14th, September 8th, 15th and 22nd, 1922.

International Foundry Congress.

No. II.*

THE remainder of the meetings of the International Foundry Congress, an account of the opening session of which was given in our issue of June 14th, were held at the Institution of Mechanical Engineers, and owing to the fact that there were sixteen papers to be presented and discussed, the Congress was divided into two sections.

A feature of the activities of the Institute of British Foundrymen is the system by which papers are exchanged between the Institute and the foundrymen's organisations in other countries, by which means the experience acquired and the progress made in the various countries are recorded. Inasmuch as the Congress this year was international, there was, naturally, an even greater number of papers by foreign authors than usual.

SOME INTER-RELATIONSHIPS IN GREY IRON METALLURGY.

An exchange paper from America, contributed by Mr. J. W. Bolton, of Cincinnati, Ohio, contained a mass of useful data which will help the foundryman to classify irons into various grades of composition, and to correlate the physical properties of these grades when melted and cast under known conditions. The author pointed out that the present state of knowledge of grey cast iron as an engineering material generally is recognised as chaotic, and that the engineer will make greater use of grey iron castings to the degree that he is informed of its desirable properties. The best material is that which fully satisfies engineering requirements in the most economic manner, and the paper, which follows a previous communication on the same subject presented last year, deals with schemes of correlation which the author feels may be in sympathy with the present trend of engineering thought.

PRACTICAL POINTS FROM THE METALLURGY OF CAST BRONZES.

Some practical problems in the metallurgy of cast bronzes were discussed in a paper by Mr. H. C. Dews, who pointed out that in bronze-founding there is a multitude of potentialities for failure, and that there is need for a higher degree of technical control than is commonly realised. A casting which, on the outside, appears to be perfectly good may be distinctly weak internally, and that such internal weakness leaves no indication of its presence on the outside of the casting is the bronze foundryman's chief pitfall. It is only by careful production and stringent testing that failures in service can be avoided; furthermore, it is apparently only slight variations in technique that may introduce such grave defects.

The author went on to discuss the process of solidification, the contraction on freezing, the temperature range of freezing, the effect of the addition of other metals, and the interpretation of the fracture of bronze. He told the metallurgist quite frankly that he is not without responsibility for the unsympathetic reception which his work often receives in the foundry, and that the greatest disability from which most scientific workers suffer is their incapacity to present their work in language which the ordinary person can easily understand. The value of a scientific worker must be measured by his ability, not only to make his work applicable to practice, but to make it understood by those whose practice it is intended to modify.

* No. I. appeared June 14th.

A point to which considerable attention was devoted both in the paper and in the subsequent discussion upon it, was the importance of being able to interpret what is disclosed by a fracture. Mr. Dews emphasised the fact that the appearance of the fracture of a bronze casting, in particular, appears to have been a fruitful source of misconception. If a bronze casting is broken open, its fracture will clearly indicate, to those who can interpret it, whether the casting is good and strong, or whether it is weak and porous. In the latter case, there may be some red and brown patches instead of the clear yellow and somewhat silky appearance associated with sound metal. An explanation of the discoloration—which it would appear slightly ridiculous to mention were it not widely quoted—is that the bronze is not mixed properly. Trade literature, either through ignorance or with a deliberate intention to mislead the foundryman, does not hesitate to trade on this fallacy. One sees advertisements of deoxidisers, fluxes, and other ingredients, the use of which is alleged to promote proper mixing of the bronze, but which actually has no such effect; for the same purpose, one is advised to cast in special moulds, to purchase ingots with a fancy name—and usually at an enhanced price—and to indulge in a variety of other dodges. The author stated quite definitely, however, that it is impossible to melt and pour bronze in the foundry without invariably securing perfect mixing, no matter whether one started with new metal, ingots, runners, or a mixture of any proportion of scrap and raw metal.

Another explanation of the peculiar appearance of the fracture of a porous casting is that the metal is oxidised. Whilst Mr. Dews admitted that this is, at any rate, a reasonable explanation, since the fracture appears to show oxide tints, and whilst the various remedies suggested will, under certain circumstances, help in producing sound castings, he pointed out that the effect of those remedies is not due to the avoidance of oxidation, and, in fact, there is plenty of experimental evidence that an oxidising atmosphere is essential to produce good-quality bronze. A false analogy has been drawn between the behaviour of copper and bronze towards deoxidisers, and this has led to the extended use of certain copper deoxidisers in the bronze foundry. The oxide of copper, which is formed when copper is melted in an oxidising atmosphere, is soluble in molten copper, whereas in bronze there are no soluble oxides, and it is essential, therefore, to prevent oxide finding its way into the casting by mechanical rather than chemical means. The first precaution is to see that the scum from the top of the melt is properly skimmed off; the oxide forming on the stream of metal during pouring must be prevented, by the use of choke runners, from being craried into the mould; and the danger of oxide forming during the flow of metal about the mould can be avoided only by a modification of the method of running.

His considered opinion is that arguments which seek to put the blame for porosity in bronze castings on oxides, gas occlusions, improper mixing, or similar secondary matters, without full reference to the volume change on freezing, and the freezing range, are liable to be misleading, and that these two latter effects are of supreme importance.

A point which was emphasised by the President—Mr. Wesley Lambert—was that not only is it necessary to educate the founder to be able to interpret a fracture, but also to agree to a standardised method of producing a fracture, because it is possible to produce fractures of quite different appearance from a bar of uniform character by fracturing in different ways.

A plea which was made by Mr. Dews and by speakers in the discussion was the necessity for the practical man to think scientifically, and in this connection the importance of a study of the equilibrium diagrams was emphasised. This led the President to point out that it was only necessary for the foundryman to study closely that portion of the curve which covered the alloy, or range of alloys, he was likely to deal with, and it was wise to avoid, if possible, the ramifications and side issues. He made the practical offer to help foundrymen out of their difficulties in connection with the equilibrium diagrams, if they would care to write to him. Further, arising out of a suggestion that the metallurgist informed the foundryman only of the faults which had resulted in the production of bad castings, and said nothing about the good ones, he urged the foundrymen to ask for a test to be made on bars which in their judgment appeared to be really good, and suggested that in most cases they would find the metallurgists happy to make it.

Die Casting.

An interesting, and indeed fascinating, review of die casting processes was given by Mr. A. H. Mundey, who began by stating that the art of die casting is of the greatest interest to the foundryman, yet it is feared that this interest is not wholehearted as a general rule. The attitude towards it is apt to be one of good-humoured tolerance, not unmixed with a trace of contempt. The interesting series of intricate die castings which he produced, however, should be sufficient to change that attitude.

He described the two main die casting processes, namely, pressure die casting and gravity die casting, and the apparatus and equipment used. The plunger type of pressure die casting is suitable for all alloys of low melting point, *i.e.*, up to about 450 deg. Cent., which include all tin-base alloys for bearings of all descriptions; special tin-antimony alloys, which are used for gas meter parts; antimonial lead alloys, for battery plates, grids, and terminal nuts for batteries, and also for certain weather-resisting window fittings and other special purposes; and zinc-base alloys, the application of which covers a vast range of engineering and general commercial work. The two main classes of alloys used are (*a*) zinc hardened with tin and copper, and (*b*) zinc hardened with copper and aluminium, the actual composition varying with the work to be done. In general, class (*a*) is used where dimensional accuracy is of the greatest importance, and class (*b*) where strength and toughness are the chief considerations.

As the most notable contribution to the available information on die casting, Mr. Mundey referred to the series of papers presented to the Institute of Metals at the Autumn Meeting in Liverpool in September, 1928, which report work carried out by the British Non-Ferrous Research Association, with the active support of the Department of Scientific and Industrial Research and the valuable co-operation of the manufacturers and their associations. These three papers dealt with the die casting alloys of low melting point—by Messrs. Russell, Goodrich, Cross, and Allen—under the direction of Professor C. H. Desch, of Sheffield University; the aluminium alloy die castings—by Messrs. Archbutt, Grogan, and Jenkins—under the direction of Dr. W. Rosenhain, at the National Physical Laboratory; and the die casting of copper-rich alloys—by Messrs. Genders, Reader, and Foster—under the direction of Dr. H. Moore, of the Research Department, Woolwich.† Mr. Mundey discussed the results of these investigators at some length, and made reference also to the work of others.

Mr. Mundey was also able to report that his company, Messrs. Fry's, recently acquired a new process in the manufacture of die castings in yellow metals, which promises to revolutionise this section of the industry. It was not possible to give intimate details in his paper, but he stated that the improvements and modifications have passed far beyond the experimental stage, and the results in actual manufacturing conditions are overwhelmingly satisfactory.

Moulding Sands.

Two papers dealing with the problems of moulding sands were presented. One of them was by Mr. H. Van Aarst, on behalf of the Dutch Foundry Technical Association. The author has made many experiments with moulding sands, and as a result expressed a preference for synthetic moulding sand, as all natural sands, both as regards grain size and the clay content, are very irregular. From the beginning of 1928 he has prepared loam, moulding sand, and core sand, using only river sand, sea sand, dune sand, and clay, the compositions of which are given in the paper. The loam consists of fine river sand, mixed with undried clay, to which flax waste and fine coal are added. Moulding sand for dry moulds is made of fine river sand, clay, flax waste, and fine coal, mixed dry. In this sand, locomotive cylinders and the heaviest type of foundation plates are cast, and it is also used for lighter castings, though in the latter case it is made up of a finer grain and without flax. For core making, sea or dune sand is used almost exclusively, but for very large cores fine river sand is prepared. The sand is dried, and linseed oil is used mainly as a binding material. The sand is tested daily for the purpose of controlling the grain size, and tests for determining the density and strength also are described.

The second paper concerned the application of coal dust to moulding sand, and was contributed by Mr. Ben Hird. It describes his attempt to prove, by practical experiments, the action of coal dust during the pouring of moulds which had been faced with sand containing a percentage of this material, and the changed condition of the sand and coal dust after use.

The sand used throughout was Stourbridge red sand of medium grade, as received from the quarry. It was dried and passed through a $\frac{1}{16}$in. mesh sieve to remove the lumps; the coal dust was well mixed in, and 5 per cent. of water was added. Three coals, of varying volatility, and ash and carbon contents, were ground separately to produce the dust. He describes in detail his experiments, in the course of which he adopted the rather novel method of making a special mould with a mica window, in order to observe what was happening inside the closed mould during casting.

His explanation of the action of coal dust on the skin of the casting is that the radiant heat immediately preceding the advance of the molten metal up the sides of the mould causes the coal dust to give off its volatile matter in the form of smoke. This condenses on the inner surfaces of the mould and coats them with a carbon deposit, thus forming a preliminary protection to the sand grains. As the advancing metal covers this active coal, the smoke impinges upon the skin of the casting, thus creating a carbon film between the metal and the sand. This reaction of the coal continues throughout the solidification range of the metal. As the heat penetrates deeper into the face of the mould, more coal dust is decomposed, evolving more gas. Under pressure of expansion, the bulk of the smoke percolates through the pores and vents of the mould into the open; some continues to keep contact with the casting skin, where, owing to high temperature, it is transformed into fixed carbon, which is deposited on to the casting and sand grains of the mould skin when the percentage of fine, high-volatile coal dust exceeds a certain ratio. A small percentage of carbon is absorbed into the skin of the casting.

The author also discusses the action of the coal dust in forming a protection for the sand grains, and concludes that superfine coal dust, ground to pass through a 40-mesh to the linear inch sieve, is the most efficient for heavy as well as for light work. In coarse-graded coal dust, unless used in large proportions—in which case it causes pock marks and other blemishes on the castings—the particles are too widely distributed amongst the sand grains to function properly, and leave much of the sand on the mould faces unprotected, or so slightly covered that the coating is burned off by the heat of the metal. The volatile content of the coal should not be less than 30 per cent.

The author does not claim that his experiments were in any way exhaustive, but points out that in the time at his disposal he had been able only to scratch the surface of the subject.

Pulverised Fuel Applied to Metallurgical Furnaces.

Messrs. H. W. Hollands and E. C. Lowndes presented a paper in which they discussed the application of pulverised coal to metallurgical furnaces, and principally to steel furnaces. They stated that, although a large amount of research and experimenting has been done in this country with regard to iron processes, difficulty has been experienced in obtaining information, and they have not been able to obtain permission to publish any of the results.

After discussing the advantages and disadvantages of the two main types of plant, namely, the bin-and-feeder and the direct-fired systems, and emphasising the importance of using dry fuel, the authors described some examples of the application of pulverised fuel firing in practice. The first was with reference to a skelping furnace which was put into operation at the works of Edward Smith, Ltd., of Wednesbury, approximately five years ago, and which has, within reasonable limits, proved extremely satisfactory. The principal saving effected was due to the lower price of the coal used as compared with that used previously.

Another installation was a pulverised coal fired continuous reheating furnace for billets, which was put into operation by F. R. Simpson and Co., Ltd., seven years ago. Trouble has been experienced in this installation, owing to the failure of the furnace bottom, but by plating the furnace with chrome bricks the trouble seems to have been overcome.

Descriptions were also given of the application of pulverised coal firing to a furnace for the annealing of malleable cast iron—this installation is in France, the authors being unable to publish figures relating to British practice—plate heating furnaces, steel melting plants, and puddling furnaces; whilst it was stated that pulverised fuel firing has also been applied successfully to soaking pits, spelter furnaces and, in fact, to almost any metallurgical process, particularly in the ferrous trade.

With regard to the application to puddling furnaces, it was found necessary to abandon all accepted practice in the firing of reverberatory furnaces with pulverised fuel, and to adopt a method whereby the pulverised coal was first gasified, and the producer gas arising from that operation was burned over the furnace hearth. This gasification system eliminated the troubles and commercial drawbacks of firing in a large combustion chamber, on the one hand, and, on the other hand, of firing directly on to a furnace hearth. The gasification system also had the advantage that scaling losses of the metals were greatly reduced, owing to the fact that excess air was practically eliminated, and a slightly reducing atmosphere could be maintained over the hearth of the furnace.

Foundry Training in Belgium.

The problem of education was dealt with in a paper presented on behalf of the Belgian Foundrymen's Association, dealing with the vocational training of foundry workers, foremen, and engineers in Belgium. This paper was descriptive of the schemes in vogue in Belgium, which have been organised by the co-operation of the educational establishments, the foundry employers, the Belgian Foundrymen's Association, and the trade unions. Not only are there day and evening courses, but also Sunday courses have been arranged. There are facilities for the systematic training of boys who are desirous of taking up moulding as a trade; courses for qualified young moulders desirous of completing their technical training; training is provided at the Arts and Crafts School of Pierrard-lez-Virton for foundry managers; and facilities for the further training of foremen are under consideration.

One of the new Sentinel-Cammell steam rail coaches of the London and North-Eastern Railway, when passing off the Goole line at Doncaster on June 9th, was run into by an excursion train from Leeds to London.

† See The Engineer for September 14th, 1928, page 282.

The Reconstruction of the Land Spans of Saltash Bridge.

THE Royal Albert Bridge, which carries the main line of the Great Western Railway across the river Tamar, was designed by Isambard Kingdom Brunel, and was built between the years 1853 and 1859 at a cost of £225,000. The structure, which bears a single pair of rails, consists of two main spans for the river crossing, each of 455ft., and seventeen land spans—seven on the Devon and ten on the Cornish side—varying in length between 70ft. and 90ft., the total length of the bridge being 2200ft. With the exception of the fitting of new cross girders in 1905 and the reconstruction of two spans at Saltash Station to enable the double line to be extended to the structure, the bridge, until recently, had remained exactly as it was built. In 1927, however, it was decided, in view of the increased weight of modern locomotives and rolling stock, to renew the main girders of the fifteen remaining land spans.

This decision necessitated solutions being found to various interesting problems, since the operations had, of course, to be carried out without materially interfering with the service of trains, and since the methods usually adopted in reconstruction work could not be employed, because the height of the main girders prevented cranes from being slewed. Furthermore, there was little or no room for the old girders to rest on the piers without attachment while the new girders were placed in position, and finally occupation of the single line over the structure could only be given for limited periods, on Sundays, owing to traffic requirements. However, profiting by experience gained in the reconstruction of the Liskeard Viaduct, the company's engineers designed a special type of erection wagon, Fig. 1, which was capable of conveying the new girders to the span to be reconstructed and then of taking the form of a carrying girder on which to slew out the old and new girders, support the weight of the floor, &c., and finally, when the work of renewal was completed, of carrying away the old girders. It may be explained that the superstructure of the original land spans consisted of wrought iron girders 8ft. deep with cross girders fixed on the skew and covered with timber decking.

It was not possible to follow exactly the same methods of procedure at both ends of the bridge, for there was a good deal more room on one side than the other. On the Devon side it was found possible to construct a yard with a siding where the new girders could be unloaded and the erection wagon made ready during the week for drawing on to the bridge on Sunday, when alone occupation of the line could be given. Then, again, the erection wagon, on the return journey with the old girders attached, could be run into the siding if there was not time to unload them alongside the main line for removal the same day. On the Cornwall side, on the other hand, there was no available site for a temporary yard, nor could the erection wagon pass through Saltash Station when carrying either the old or the new girders, as there are two overbridges which prevented the lifting of the girders above the platform level. On that side, therefore, it was arranged for the wagon to be stabled in a loop siding which was cut-out, and slewed to give the necessary clearance, from the main line. The new girders were unloaded on the Sunday morning on the last

The erection wagon comprised a steel lattice girder 95ft. long, 9ft. 0¾in. deep, and 4ft. 3½in. wide, weighing about 18¼ tons. Attached to the top of the boom were transverse girders forming four cross members, through each of which passed a centrally-fixed pintle shaft to enable them to pivot and so come within the load gauge while being transferred over the bridge to the Cornish side. Within each pair of cross girders were fixed 2¾in. lifting screws with Whitworth square threads about 8ft. long, furnished with ball bearings. These screws were each

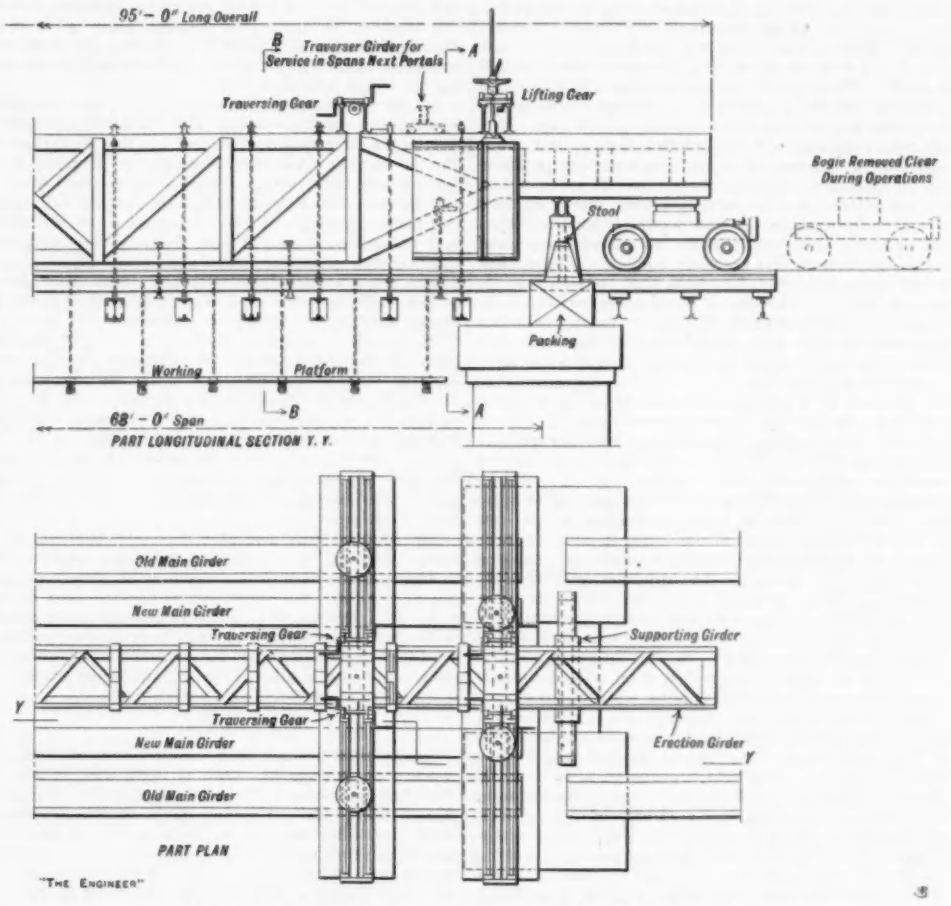

FIG. 1—PART ELEVATION AND PLAN OF ERECTION WAGON

tested for a working load of 15 tons. The traversing gear was controlled by similar screws, each about 12ft. long, and upon the top booms of the transverse girders were arranged rails of bridge section, 24 lb. per yard, on which the distances from the centre were indicated in feet and inches.

Attached at each end to the underside of the main steel lattice girder was a box girder 12ft. in length, and it was possible to adjust the positions of these girders to suit the different lengths of span to be dealt with. When the bridge girders were being replaced these girders rested on stools and carried the total weight during the time that each of the girders of each span was being replaced.

The top cross members were arranged approximately above each of the cross girders of the bridge span, and from them were suspended screwed steel rods furnished with wire cables and bridles for lifting and holding each cross girder separately. Similar attachments were connected to the lower boom, and by them the permanent way, timber decking and staging were temporarily raised. The erection girder was provided at each end with a standard engine bogie, with special wooden frames, so that it could be propelled at slow speed. The total weight of the erection wagon thus formed when carrying the old and new girders, &c., was in the neighbourhood of 80 tons.

The new main girders, which varied in weight from 15 to 21 tons each, were conveyed to the site from the manufacturers' works on Crocodile "D" wagons. The cross girders of the bridge, which, as mentioned above, were put in in 1905, were re-used and riveted to the new main girders.

In order to avoid having occupations of the main line during the height of the summer traffic the work of reconstruction was divided into two sections, the first dealing with the seven land spans on the Devon side and the second with the eight spans on the other side of the Tamar. Preliminary work on the first section was begun at the end of February, 1928. It consisted chiefly (*a*) in the erection of close-decked scaffolding suspended under each of the seven spans; (*b*) in the laying of a horizontally-supported track in place of the former cross sleeper road; (*c*) in separating by means of oxy-acetylene flame the original cross

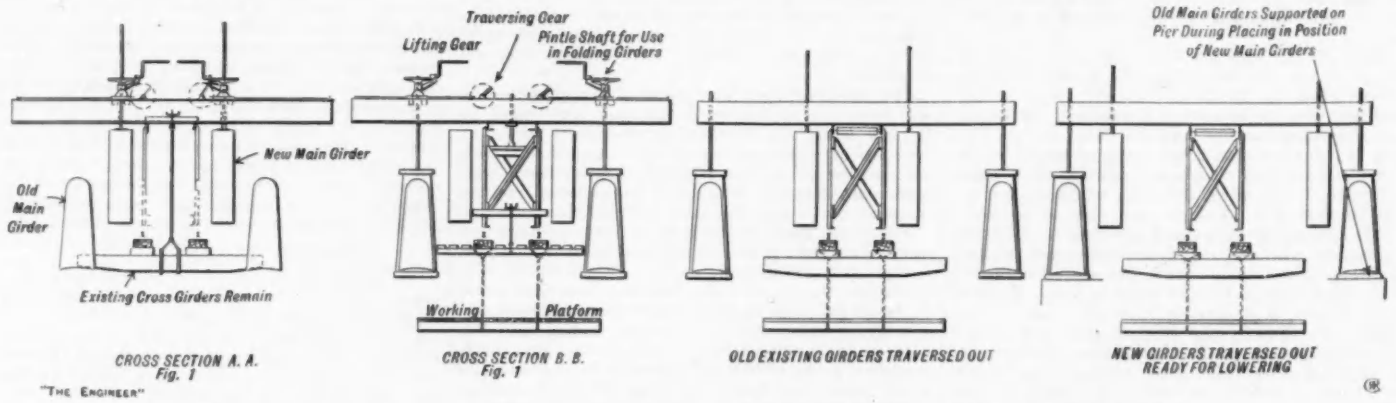
Traversing Gear
Lifting Gear
Pintle Shaft for Use in Folding Girders
Old Main Girders Supported on Pier During Placing in Position of New Main Girders
New Main Girder
Old Main Girder
Existing Cross Girders Remain
Working Platform
CROSS SECTION A. A. Fig. 1
CROSS SECTION B. B. Fig. 1
OLD EXISTING GIRDERS TRAVERSED OUT
NEW GIRDERS TRAVERSED OUT READY FOR LOWERING
"THE ENGINEER"

FIG. 2—DIAGRAMS ILLUSTRATING STAGES IN REMOVAL OF OLD AND SUBSTITUTION OF NEW GIRDERS

span in such a position as to allow the erection wagon to be run between them for dressing and afterwards the old main girders were dropped in similar positions for removal by rail before the occupation was given up.

Before the actual work of replacement was begun, it was found necessary to substitute the longitudinal type of track for the pre-existing cross sleeper road. This change was made, first, because it was more easy to lift the longitudinal road than the other; secondly, to obtain as much room as possible outside the rail to allow the new girders to be lowered on to temporary packings while the erection girder was being lifted on to the stools; and thirdly, to enable a scaffolding below the span to be attached to the road during the progress of the work.

girders which were left in position when the new cross girders were added; and (*d*) in levelling the tops of the piers and that of the abutment, building up a recess in the latter and strengthening the former. The reconstruction work proper was begun on March 18th, and continued till July 29th, when the last of the seven spans on the Devon side was got into position. Work on the Cornish spans was started on September 23rd and the last span was got into position on January 20th of this year, work having been suspended during the Christmas holidays to meet traffic requirements.

The method of carrying out the reconstruction work, the stages of which are shown in the diagrams in Fig. 2, was as follows:—The erection girder resting on

its bogies and thus forming what we have termed the erection wagon, was slowly propelled on to the span to be reconstructed, carrying with it the two new main girders suspended on the lifting screws and hanging close in so as to give as much clearance as possible on the outside when travelling over the bridge and during the initial stage of the work. When the centre point of the erecting girder had arrived immediately over the exact centre of the span, from which all measurements were taken, it was firmly scotched in position. It will be understood that the bogies of the erection wagon were then quite clear of the span which was to be reconstructed and were supported by the piers at each end of that span. The erection girder, in fact, constituted a bridge by itself. Each cross girder was then connected to the wire rope attached to the hand screw fixed to the corresponding cross member on the top of the erection girder. The service bolts connecting the cross girders to the old main girders were then removed. At the same time the permanent way, the decking, and the scaffolding which had been erected below it, were coupled up to the screws on the lower members, and the screws were then tightened up sufficiently to enable the wedges between the decking and the cross girders to be removed, thus lifting the weight off the cross girders.

During these operations stools, two at each end, were fixed under the box girders on the underside of the erection girder, and four 35-ton hydraulic jacks were arranged in recesses provided for them so that they could be brought to bear on the ends of the erection girder—Fig. 3. The latter was then raised from 5in. to 7in. and packed at that height on the stools. As the cross girders were depending from the erection girder they were lifted through the same height as it was, and it was sufficient to clear the bearing angles on the new girders and to relieve the bogies of the erection girder of the weight. The new main girders had been lowered on to temporary packings and the screws released while the erection girder was being lifted. The next business was to lift and to move outwards the old main girders so as to permit of the new main girders being got into position. To effect this operation, four men were detailed to work each of the four sets of screws, with one man in each gang to check the horizontal and vertical movements. To ensure that all should work together the travel was limited to 6in. When that distance had been covered the movement was stopped for the time being. A whistle was blown when each start had to be made, as it was very desirable that all the movements of the girders should correspond so as to ensure that both should at all times be at an equal distance from the centre of the erection girder.

When the old main girders had been respectively traversed outwards from the centre of the bridge far enough to clear everything when drawn off the bridge by the erecting wagon, and also to give sufficient clearance to enable the new main girders to clear the ends of the cross girders, they were lowered so as to rest on those piers which were wide enough to provide a resting place for them, but they were also held suspended from the cross members of the erection wagon. Then, after their beds had been prepared for them, the old bed-plates being removed and new ones substituted, the new girders were picked up, travelled outwards, lowered, drawn into their correct positions, and then finally set on their beds.

The cross girders were then got into position and riveted up to the main girders. Originally these cross girders had been set slightly on the skew, but as, for the reconstructed spans, it was decided that they should be set at right angles to the main girders, it was necessary to have tapered packing plates to fix them to the new girders. The permanent way was then lowered on to the cross girders and the rails jointed up. The hydraulic jacks were then pumped up so as to take the weight of the erection girder off the packings, which were then withdrawn and the girder lowered on to its bogies. Before that was done, however, the old main girders had been raised through a sufficient height to ensure that when the erection girder was lowered, as just explained, they should hang freely and clear of any support. When work on the span was completed, the wagon carrying with it the old main girders suspended outside the new main girders, was slowly drawn back to its starting point, where the old girders were deposited beside the line ready to be taken away.

The foregoing describes briefly the procedure followed in the case of each of the spans, except the two spans—designated the portal spans—abutting the side piers of the two main spans. For these two spans additional movements had to be introduced in dealing with the old and new girders, since the former were fitted into recesses 2ft. 6in. deep with very little clearance at the tops and sides. To provide for these movements special traversers were designed to run on the top flanges of the erection girder. These traversers, which were furnished with screw attachments capable of holding the girders in position after they had been lifted by main screws, withdrew the girders from the recesses. The girders were then reconnected to the main screws and thereafter dealt with in the same manner as were the girders of the other spans. The new girders were got into the recesses in like manner, but, of course, in the reverse order.

Commenting on this portion of the work, the railway company's engineers remark:—"One of the difficulties encountered on these spans was that of clearing the ends of the cross girders when the new girders were being placed in the recess, as the web stiffeners fouled them and the girder could not be moved outwards. When it is mentioned that work on these spans took over three hours longer than on the others, and that when drawing the old girders

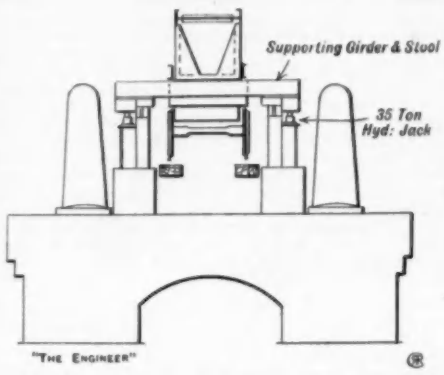

FIG. 3—METHOD OF SUPPORTING ERECTION GIRDER

away from the one at the Cornish end it was only possible to lift them to a certain height which prevented them clearing the top of the rail by ¼in. when drawing them on to the end span for loading, and that it took over three hours to make the necessary adjustments, it will be realised there was very little margin in the working dimensions to play with, especially as the Devon spans are constructed on a curve of 17 chains radius, while those on the Cornish side are of a 14-chain curve."

The following particulars regarding the average times taken for the various operations are of interest:

Devon Spans.

	Hrs.	min.
Propel erection wagon from siding to span under reconstruction; connect cross girders, permanent way, &c.; lower main girders and lift on to stools	1	40
Traverse out old main girders, remove old bed-plates, and fix new	0	30
Lower and traverse out and set in final position new main girders	0	30
Fix cross girders, lower permanent way, adjust and reset erection girder on bogies	1	0
Travel back erection wagon, with old main girders attached, to site for unloading	0	50

Total time, 4 hours 30 minutes.

Cornwall Spans.

Unload new main girders, between train occupation	0	45
Propel erection wagon from siding to west end of Saltash Bridge and load new girders	0	30
Propel erection wagon to span under reconstruction; connect cross girders, permanent way, &c., lower main girders and lift on to stools	1	0
Traverse out old main girders, remove old bed-plates and fix new	0	50
Lower, traverse out and set in final position new main girders	0	20
Fix cross girders, lower permanent way, adjust and reset on bogies	0	50
Travel back erection wagon with old main girders attached for unloading	0	30

Total time taken during absolute occupation, 4 hours.

Portal Spans.

Propel erection wagon to span; connect cross girders, permanent way, &c., and lift on to stools	2	25
Lift old main girders; transfer weight to traverser and draw out of portal; re-transfer to main screws; remove old bed-plates and fix new	1	30
Traverse out new main girders; transfer to traverser and draw into portal; re-connect to main screws and lower	1	20
Alter portion of each cross girder and adjust on new girder	0	30
Lower permanent way; adjust and reset erection wagon on bogies	1	0
Travel back erection wagon to site for unloading	0	45

Total time, 7 hours 30 minutes.

The reconstruction was carried out according to a programme prepared before the work commenced, and although on two Sundays the work was cancelled owing to a gale in one case and a snowstorm in the other, contingencies such as those had been allowed for and the last span was reconstructed on the date anticipated. On the first and succeeding Sundays when the work was done, occupation of the main line was obtained for limited times, during which period the original cross girders were removed, the old timber decking renewed, and the new main girders unloaded from the "Crocodile" wagon and placed in position alongside the erection girder in the siding. On the Sundays when the girders of each span were renewed absolute occupation of the line extended from about 9 a.m. to about 2 p.m. on the first section and from 9 a.m. to 5 p.m. on the second section.

The whole of the reconstruction was carried out by the company's staff, the average number of men employed on Sundays being forty-six. The steel work was supplied by the Fairfield Shipbuilding and Engineering Company, Ltd., of Chepstow, which sublet the lifting and traversing gear to the East Ferry Engineering Works Company. It is satisfactory to be able to report that no serious accident occurred during the forty-three Sundays on which the work was being carried out.

We are indebted to Mr. Raymond Carpmael, M. Inst. C.E., the Chief Engineer of the line, for permission to publish the foregoing description of this interesting undertaking, as well as for the particulars from which it has been prepared, and for the illustrations which accompany the text and appear in our Supplement of to-day. We have also to tender our thanks to Mr. E. G. G. Matheson, M. Inst. C.E., the Assistant Chief Engineer of the Great Western Railway, for courteous assistance during the preparation of the article; and to Mr. H. S. B. Whitley, M. Inst. C.E., Divisional Engineer, Plymouth, who was responsible for the carrying out of the work.

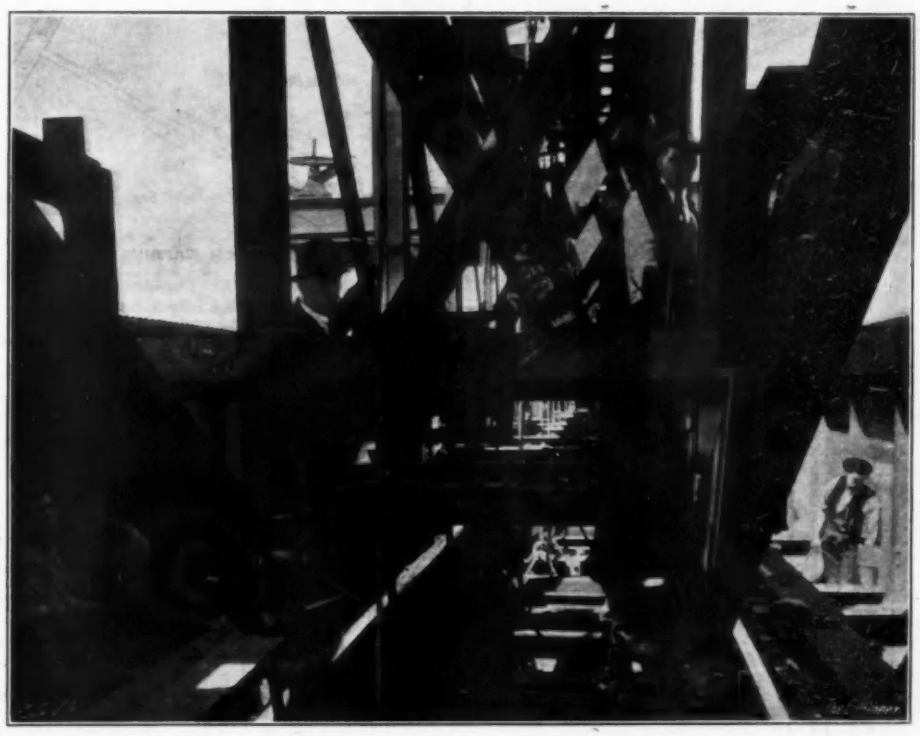

FIG. 4—ERECTION GIRDER SHOWING CHAINS SUPPORTING PERMANENT WAY AND CROSS GIRDERS

A DISPATCH from Leningrad announces that the construction of the second largest electrical station in the U.S.S.R., which is to have a capacity of 280,000 kilowatts, is shortly to begin at Malaya Vishera, 135 kiloms. from Leningrad. The station will work on local peat found abundantly on the banks of the river Volkhov. Practically all the machines and equipment for the station will, it is stated, be produced within the country. The cost of the station, together with a transmission line to Leningrad and sub-stations, is estimated at 100,000,000 roubles, say, £10,000,000.

The Partington Gasworks of the Manchester Corporation.

EARLY in the year gas was first made in the first portion of the new Partington Gasworks of the Manchester Corporation built in accordance with the policy of the gas department to liberate the sites in Gaythorn and Rochdale-road, thereby removing manufacture from the centre of the city and taking advantage of the Ship Canal and the better railway communication with the coalfields which is available at Partington. The new works—Figs. 1 and 2, Manchester, and the plant is a very complete one, embodying every development of this system, including mechanical coal and coke-handling plant and waste-heat recovery. which will be visited by the Institution of Mechanical Engineers next week—stand on Carrington Moss, and the general ground level being some 22ft. below the level of the railway, it was possible to build out extensive sidings in reinforced concrete, forming a coal store of 35,000 tons capacity without undue cost.

The site has been planned for an eventual daily capacity of 40 million cubic feet of gas, but that of the section which is complete is only about 8 millions. The carbonising plant is in two sections of about 4 millions daily capacity each, one section consisting of continuous vertical retorts and the other of horizontal retorts. The continuous vertical retorts are on the Glover-West system, manufactured by West's Gas Improvement Company, Ltd., Coal is received from the overhead gantries, broken and transported to the bunkers above the retort bench in either of two lines of West lip-bucket conveyor. Each of these conveyors encircles the whole retort house, receiving coke from the base of the retorts for transport to 150-ton reinforced concrete coke hoppers, with screening plant situated at the yard end of the retort house. Surplus coke is received by an electric crane running on a ferro-concrete gantry and capable of storing 1200 tons in the coke yard. The feeding of the crane skips is done automatically, and coke can be reclaimed from the yard and returned to the screens by means of a grab operated from the crane.

The waste-heat recovery plant consists of large duplicate Spencer-Bonecourt induced-draught fire-tube boilers, in which 50 per cent. of the steam-raising capacity of the coke fed to the producers of the retort bench is recovered. The horizontal retorts—which are not yet in operation—

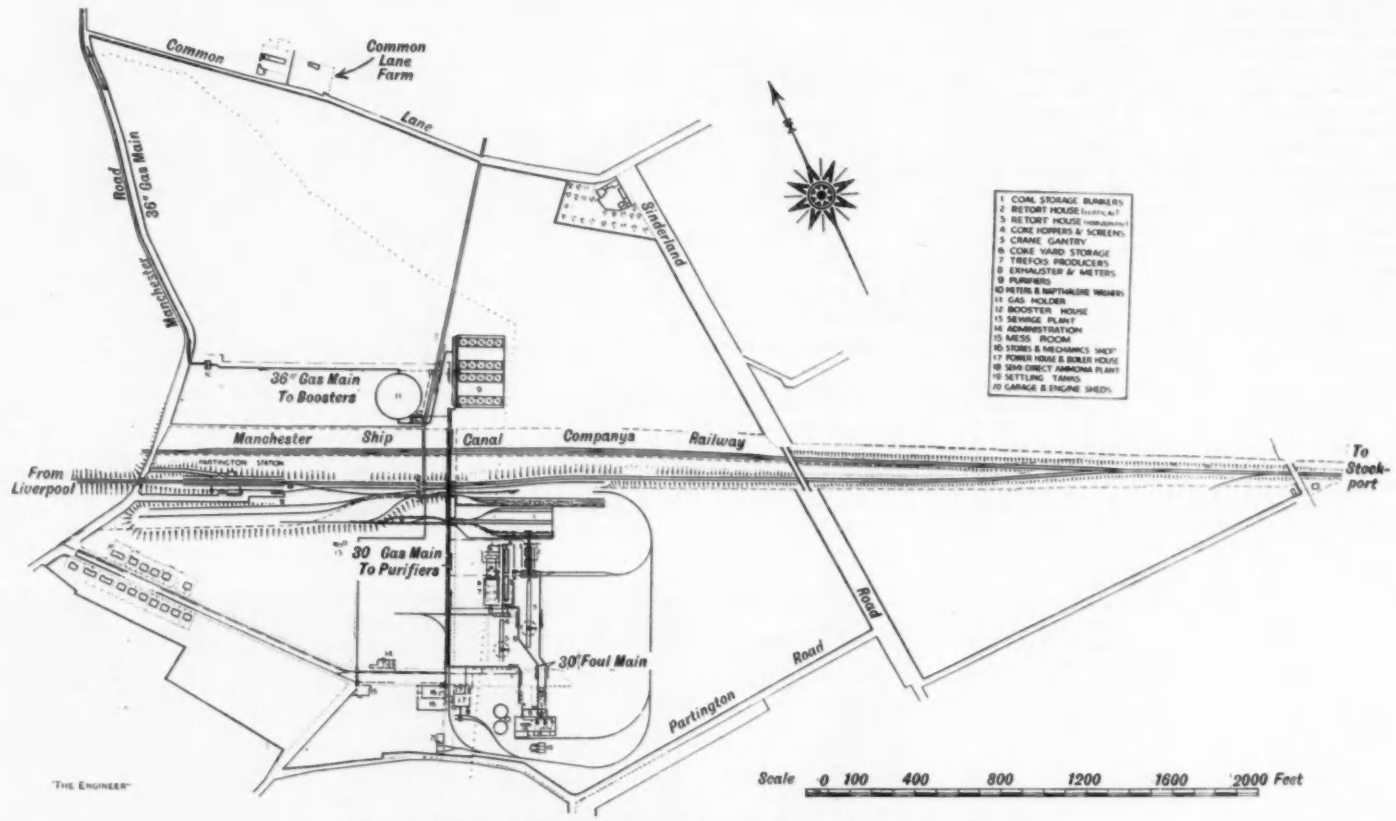

FIG. 1—PARTINGTON GAS WORKS ON CARRINGTON MOSS—PLAN OF SITE

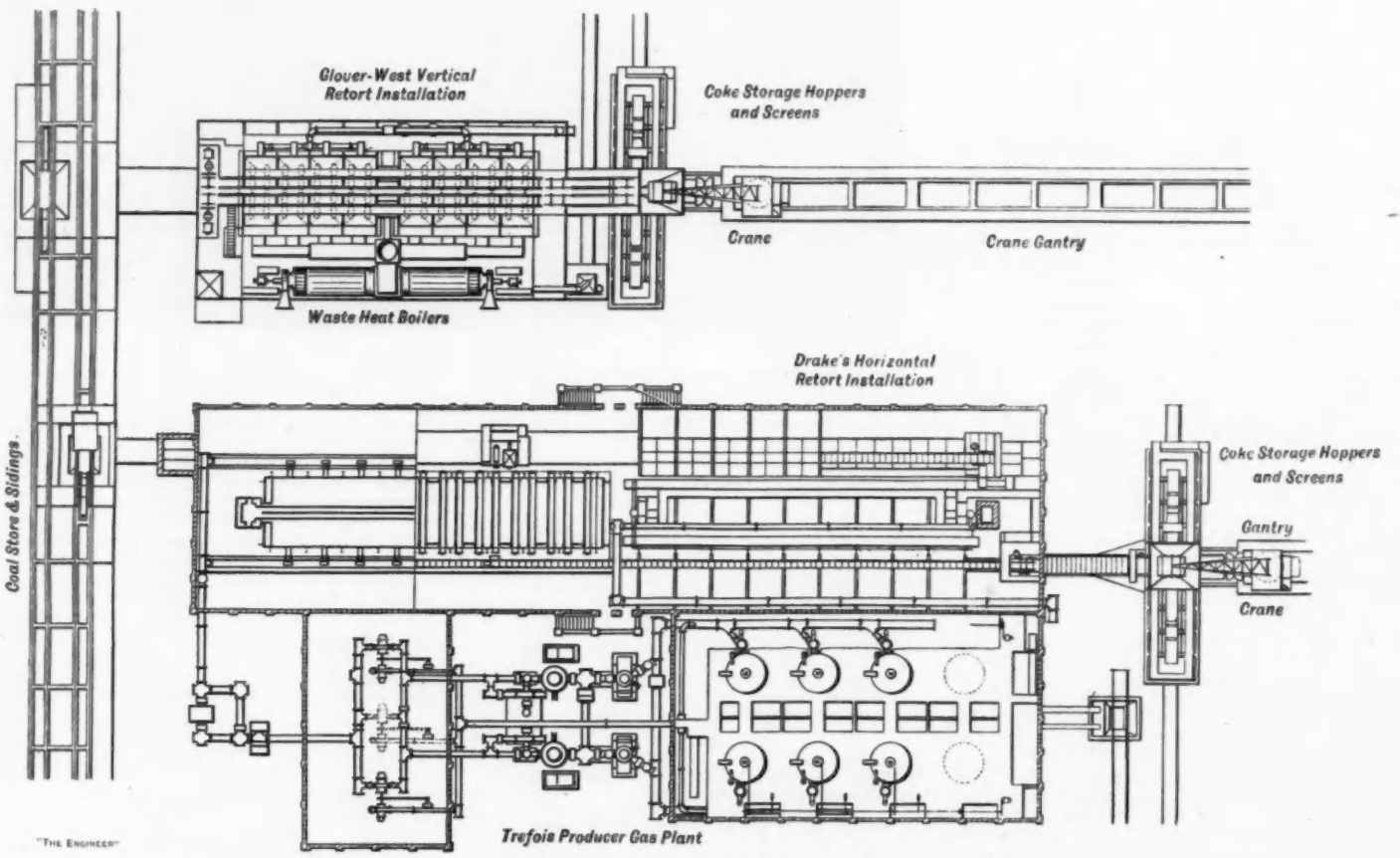

FIG. 2—GENERAL ARRANGEMENT OF PLANT

are by Drakes, Ltd., Halifax, and are designed on the most modern lines with stoking machinery. Incandescent coke from the retorts is received by a drag link conveyor, quenched and fed to a skip hoist at the end of the retort

house, where it is dealt with similarly to that from the vertical retort house. These retorts are to be heated by gas from a special outside producer plant, which is the first of its kind on anything like a large scale to be built in this country. It consists of six Trefois producers, each capable of gasifying about 10 tons of coke breeze per diem. The producers are arranged in a house parallel with the horizontal retorts, and are equipped with handling plant, gas cleaning and scrubbing plant. The vertical retorts are also arranged for gas heating as an alternative to the usual built-in producers. The Trefois producer is a low-pressure machine and claims to be able to deal with unscreened breeze.

The Trefois producer is shown in sectional elevation in Fig. 3. It comprises a cylindrical body which encloses a revolving grate and driving mechanism, with an ash hopper underneath in the form of an inverted cone sealed in a revolving ash-pan. The producer proper rests upon this base and is water-jacketed. The ash-pan is filled with water and is caused to revolve slowly by means of the gearing shown. It is furnished with scraper arms A, which scrape the ashes down the fixed cone forming the ash hopper, while the ashes which fall upon the table top are removed by the fixed scraper B. The ashes thus collected in the pan are withdrawn by means of a fixed plough. The base C encloses the grate, which consists of three concentric rings revolving at different speeds on ball paths and driven by pinions D on the shaft E through gearing F. The grate rings are pierced with openings covered with grid boxes H, having open sides, facing the direction of movement and the centre of rotation, through which the ashes fall.

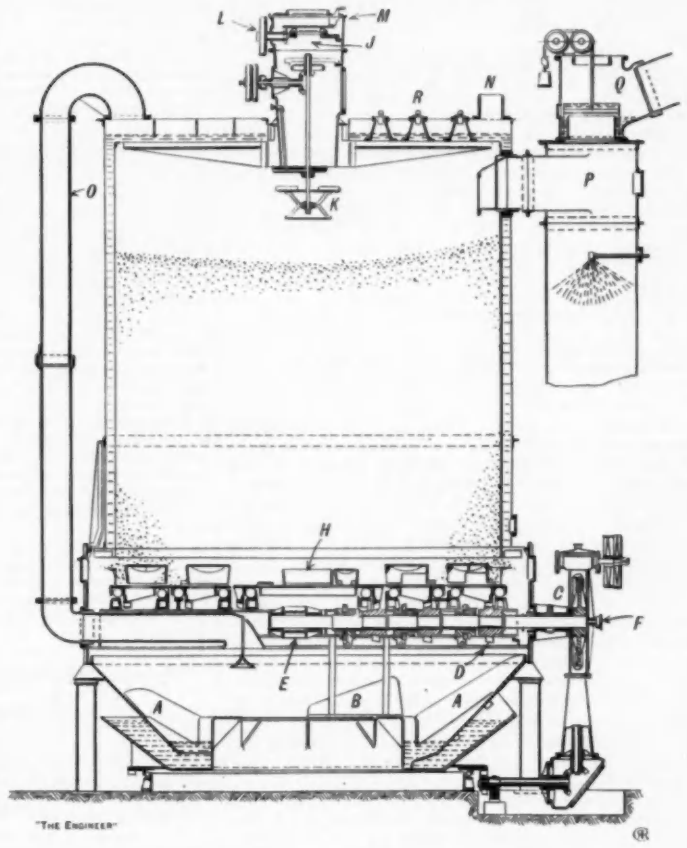

FIG. 3—SECTION THROUGH TREFOIS GAS PRODUCER

Rotary movement causes the grid boxes to plough and gather the ashes through the open sides of the boxes, while clinker is broken up and the mass kept in movement. The grid boxes rotating at different speeds break up the clinker, keep the hearth open over its whole area, and ensure an equal distribution of the air, thus preventing the formation of "chimneys" in the fuel bed. The producer body is water-jacketed, and has no refractory lining, and the cover is also water-jacketed. The central charging hopper has a continuous automatic charger J and distributor K. The charger comprises a feed table L supporting a column of fuel from a bunker, its diameter being such that the angle of rest of the fuel forms a natural heap. The table is revolved by bevel gears, and the fuel is removed from it by adjustable scrapers M, by means of which the quantity can be regulated. The construction of the distributor is such that the fuel is discharged partly from the top table and partly from and through the bottom table. Air for combustion enters from a blower through the pipe N, and circulates between baffles which give it a long path in the space above the water level, whence, in a saturated condition, it flows through the pipe O to the ash hopper under the grate. The gas leaves the producer through the tube P. Q is a water sealed valve to the chimney, which is lowered while working and lifted when laying off the producer to allow the gas to escape.

The producer is equipped with a blower-exhauster group driven by a common motor. The air is blown under the grate in such quantity that the make of gas corresponds with the consumption. Variations in the demand for gas create variations in pressure under the producer, which are transmitted to a bell-float governor mounted on the gas outlet and operate a butterfly valve which regulates the air supply. Thus, the pressure ruling on top of the producer is maintained practically constant at atmospheric pressure. The float is regulated so that the pressure corresponds with the pressure of the atmosphere so as not to allow air to enter or gas to disengage while inspecting the fuel bed from the poking and sight holes R. The arrangement is claimed to be sensitive enough to allow pressure differences below 1 mm. of water gauge to be corrected immediately. The gas is exhausted by the other members of the blower-exhauster group, its duty being regulated by a governor-controlled butterfly valve. The blower and the exhauster are, therefore, balanced.

Another exceptional feature of the Partington works is the semi-direct ammonia-recovery plant erected by W. C. Holmes, Ltd., of Huddersfield, also the first of its kind to be erected in connection with a large gasworks. The steam-raising plant comprises four Stirling boilers fitted with special chain grates for the consumption of coke breeze. The exhausters are of the turbo-type, and the station meters are of the rotary type. Exhausters and meters of these types occupy much less space than the older design, and are here accommodated together in a comparatively small room.

Storage is provided by one spirally-guided gasholder of 5-million cubic feet capacity erected by R. and J. Dempster, Ltd., of Manchester; this, with the dry purification plant, being placed on the other side of the railway. Other buildings include power-house, stores and garages and office buildings with extensive laboratories for the scientific control of manufacture. The whole is laid out on the most spacious lines with a view to ultimate expansion to the full capacity of 40 millions. Gas is conveyed 10 miles to the city in a 36in. trunk main, where it is distributed from the Gaythorn Station.

Annual Advertising Convention.

THE fifth Annual Advertising Convention opened at Newcastle-on-Tyne on the 15th inst. and was attended by more than a thousand members of the Advertising Association.

Monday, the 17th inst., was given up to speeches and addresses covering many subjects, but all directed to the subject of the meeting, "The Quest of Markets." We do not propose to deal with papers read at the Convention other than those which immediately concerned the Industrial Press Section. With Sir Edward Iliffe, Bart., C.B.E., presiding at this Section on Monday afternoon, a useful and instructive discussion took place. It is to be regretted that there was not a larger attendance, but it must be remembered that a long session, during which at least six speeches were delivered, had taken place in the morning; that it was followed by a luncheon given by Sir William Berry and the directors of the *Newcastle Chronicle*, when further eloquent orations were delivered, and that, simultaneously with the Industrial Press Session, three other sessions were actually in progress, all of which had relation to very interesting and absorbing topics.

Sir Edward, in his opening remarks, stated that the meeting would consider four papers, the first by Sir Gerald Chadwyck-Healey, Bart., C.B.E., Chairman of Morgan Brothers (Publishers), Ltd., who represented the industrial Press, and the second by Mr. Victor Watlington, M.B.E., M.I.E.E., Managing Director of the English Electric Company, Ltd., and Chairman of the British Electrical and Allied Manufacturers' Association. These two gentlemen would represent the views of the industrial Press and the manufacturers respectively. The third address would be given by Mr. E. M. I. Buxton, F.I.P.A., Director of Paul E. Derrick, Ltd., who represented the advertising agents. After these three addresses had been delivered, opportunity would be given for discussion. The session would then close with an address by Mr. Percival Marshall, C.I. Mech. E., Chairman of the Periodical, Trade Press and Weekly Newspaper Proprietors' Association, Ltd., Percival Marshall and Co., who would sum up the remarks made by the three foregoing speakers.

In his speech Sir Gerald Chadwyck-Healey said that what the meeting had to consider that afternoon was the value of the trade and technical newspaper to the manufacturer, and through him to the purchasing public. Scientific research and discovery was immensely important to industry. Better industrial processes and equipment meant better and cheaper production. Existing markets were expanded and new markets were opened up as the result of industrial and scientific progress, and in all those directions news was of vital importance. It was the function of the industrial Press to collect and distribute that news. The daily newspaper could not possibly devote sufficient space to serving the needs of industry. It was extremely useful in drawing the attention of the world to any great happening in the scientific and industrial line, but, having done that, it left it to those really interested to turn to the specialised Press for a full and lasting account of the subject in question. The modern industrial newspaper was a highly efficient organisation. In addition to its own competent and highly skilled technical staff, it enjoyed the collaboration of the leaders of thought in the scientific and industrial world. It was thus able to keep the industrial and commercial community informed of the very latest happenings in their particular field.

How was the overseas purchaser to learn what new line of manufactured goods was forthcoming from this country? He could be told through agents, by sending him catalogues, by personal correspondence, but the most efficient, the cheapest and most secure way was through the columns, both editorial and advertisement, of the industrial newspapers. Sir Gerald said he used the word "secure" because the reputation of the industrial Press of this country stood so high throughout the world that potential buyers were prepared to put faith in what they read in its columns. A high-class industrial Press did much to improve the prestige of the industry and country to which it belonged. In other words, a high-class industrial newspaper carried with it to the country in which it circulated the feeling that the industry behind it was of great importance. The speaker then indicated a few of the ways in which the industrial newspapers help industry. Many of these journals had, he said, built up and established inquiry departments as a means of answering questions on technical and commercial matters, and in the case of three journals with which he was connected no less than 37,500 inquiries were dealt with during the course of last year. In some cases directories and diaries containing much useful information are published annually in the interests of advertisers and for whose entries no charge is made. The outposts of the world formed the extremes of the activities of industrial newspapers. Editorial representatives were established in many parts of the world, and from time to time special commissioners were sent abroad to report on the state of industry and the condition of markets in far-off lands, so that those who run at home might read.

In conclusion, Sir Gerald said that while much progress had been made, much remained to be done. He was convinced that sooner or later, and the sooner the better for British trade, every manufacturer would consider that the journal which represented his particular industry editorially and to which he paid money in the shape of advertising space was in reality part and parcel of his own business, a component part of the machinery which helped to generate the power which ran his works and influenced his sales.

Mr. Victor Watlington said the fact that many of our trade journals had been in existence for well over half a century showed that industry needed the great services which the industrial Press so ably rendered. His own experience led him to think that neither the industrial Press nor the industries which that Press represented had realised sufficiently the value of co-operation, more particularly in opening up and expanding overseas markets. The technical Press should not be regarded as something separate which could exist by itself, but rather as an integral part of industry, and therefore vitally interested in the welfare of industry and willing to take its share in its development. Industry must not look on the technical Press as a rapacious monster, whose only function was to extract as much money as possible from manufacturers, but as a part of its own organisation which must be kept fully posted as to the views and aspirations of that particular industry. British manufacturers would appreciate all the support which the trade Press could give them through the creative power of publicity in fostering goodwill and confidence in their products. He was pleased to hear Sir Gerald Chadwyck-Healey suggesting closer co-operation between industry and the technical Press, and he ventured to predict that if that co-operation could be secured the industrial and commercial interests of the great industries of this country would derive such benefit as would enable them to advance the theme of that conference from "The Quest of Markets" to "The Conquest of Markets." He appealed to the representatives of publishers of Great Britain's trade and technical Press to co-operate with the manufacturing and commercial interests, and seek by joint collaboration the practical means which would bring not only mutual benefit, but development and prosperity to the industries of this land.

The address delivered by Mr. Buxton dealt mainly with what may be described as an internal problem between advertising agents and the Press and had relatively little bearing upon the subject of debate, namely, "The Industrial Press and the Quest of Markets."

On the conclusion of Mr. Buxton's address, the Chairman invited discussion, in which several gentlemen took part. It is worth mentioning that, without exception, all the manufacturers who spoke affirmed their belief in the value of their own trade and technical Press as the right and proper media for their advertising, as compared with the great national dailies, which however valuable for what is known as national advertising, were regarded by them as unsuitable for advertisements of specialised manufactures.

Summing up the debate, Mr. Percival Marshall said that in the quest for markets the outstanding need of industry was publicity in every effective form. In the industrial Press that meant editorial as well as advertising publicity, and the industrial editor was willing and even anxious to help. But manufacturers must help themselves by giving editors real technical news of their doings. In many quarters there was a decided apathy on the part of manufacturers towards that responsibility to their industry. They would readily send in paragraphs about whist drives, dances, cricket matches, and other social activities of their staff, but news of real technical importance to their industry was often too much trouble to prepare, or was jealously guarded as a profound secret. As an example he said that last year he was invited by an American technical magazine with a very large circulation to contribute some articles on recent engineering progress in Europe. He wrote to a firm on the North-East Coast, which had just completed a very fine job, and asked for some technical details and some photographs, stating the purpose for which they were required. He received a few scanty facts about the work, and was told that if he required photographs he must communicate with a local firm of photographers, to whom the privilege of selling photographs had been allotted. Imagine the feelings of a busy journalist, anxious to do British engineering a good turn, when confronted with a response of that kind! Not only was he expected to spend time in corresponding with the photographers to find out what prints were available, but he was also expected to pay for anything he might wish to use. Then for a contrast. He wrote to a German firm

which had recently built a very interesting engine. In a few days he received through its London office a full technical description of the engine and a first-class photograph, with the offer to furnish any additional information required.

He gave a further example. A firm which exhibited at the British Industries Fair wrote to a leading technical journal and said it was very disappointed at the brevity of the reference to its exhibit in that paper. The editor replied that the firm had only itself to blame; he had written to it four times before the Fair opened, asking for advance particulars of its exhibit, and had received no reply at all. Imagine the gigantic task of reporting a large Exhibition such as the British Industries Fair, with its 8 miles of trade stands. Was it too much for the editor to expect practical co-operation from the exhibitors in the form of advance descriptions of the technical features of the products on view? Those experiences were perhaps exceptional, but they served to indicate that greater vision in publicity matters was still needed in some directions.

Many manufacturers failed to utilise effectively the valuable news service provided by the industrial Press. Often a large firm would subscribe for only one copy of a paper, which might stay for days in a director's or manager's office. Sometimes that copy was circulated among other members of the staff in rotation, a list of the authorised recipients being attached to the front page. That method was better than no circulation at all, but it was really very inadequate. Several copies should be subscribed for and circulated promptly to the different departments, so that the latest technical information, the latest materials and equipment, the news of openings for business, and the commercial, legal and market intelligence might become known to the responsible executives at the earliest possible moment. Savings in production costs, opportunities for making sales or tendering for contracts, and other important advantages might be lost through the news provided by the paper not reaching the right executive quickly enough.

Those who had so kindly contributed to the proceedings that afternoon had been preaching mostly to the converted. They were all agreed on the main principle of greater co-operation between the sections he represented. But outside those four walls there was a vast industrial community to which greater and more efficient publicity was of the utmost importance. Let them all endeavour to spread the spirit of mutual understanding, of united effort, and of more efficient service, so that the effect of that first Industrial Press Session might be felt with advantage in manufacturing, merchandising, and publishing circles throughout the whole of the British business world.

Obituary.

HENRY NEWMARCH ALLOTT.

UNIVERSAL regret will be felt amongst civil engineers at the untimely death of Mr. H. N. Allott which occurred on Monday last, 17th inst., after a very brief illness, at his home, Cromwell-road, Stretford, near Manchester. Mr. Allott, who was sixty years of age, was the principal in the firm of C. S. Allott and Son, consulting civil engineers. He had entered into partnership with his father three years before the latter died in 1907. Afterwards he conducted the business single-handed until two years ago, when he took as partner his nephew, Mr. A. C. Deane, M. Inst. C.E.

Mr. Allott was an old Manchester Grammar School boy and served his pupilage under the late Mr. Wm. Hunt, M. Inst. C.E., who was chief engineer on the Lancashire and Yorkshire Railway Company—now absorbed into the London, Midland and Scottish Railway.

In recent years Mr. Allott had been chiefly concerned with power station undertakings, and was carrying out civil engineering work at the three well-known Manchester stations—Stuart-street, Barton, and Agecroft. He acted also as civil engineer to the Wimbledon power station of the Southern Railway, and he was co-operating with his old friend Dr. S. L. Pearce in connection with the lay-out of the much-discussed Battersea power station. It may, indeed, be said that there are few engineers in this country who had had more experience with power station design than Mr. H. N. Allott. Although that branch of his profession was most prominent, he also acted as engineer to the Isle of Man Railway—a post he had held for ten years.

Mr. Allott had not much time to devote to other matters than engineering, but he was an active member of Council of the Institution of Civil Engineers, and was on the Local Associations and Professional Sub-committees. He was also a member of the Institution of Mining Engineers, and one of the founders and past-Chairmen of the Engineers' Club, Manchester.

FRANK HICKMAN.

THE death is announced of Mr. Frank Hickman, chairman of Buck and Hickman, Ltd., of Whitechapel-road, E. 1, as having taken place on June 3rd, after a short illness.

Mr. Hickman was sixty-two years of age, and had been connected with the firm for nearly fifty years. His father, the late Mr. John Roe Hickman, founded the business, and Mr. Frank Hickman succeeded his late brother as chairman.

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

GRAND JUNCTION RAILWAY LOCOMOTIVES.

SIR,—I am extremely obliged to Mr. Laidlaw for his interesting letter. With regard to the engines "Prince" and "Princess" there is a difficulty which requires clearing up.

A minute of the directors of the G.J.R., dated January 15th, 1840, records that it was resolved to order three engines from Tayleur and Co., and three from Melling and Co., at the prices respectively offered by them. On January 13th, 1841, it appeared none had been delivered; Mellings giving want of capital as an excuse; to whom a letter was written, threatening not to take the engines if further unreasonably delayed. On January 12th, 1842, Captain Huish was "desired to cause the two new engines from Melling and Son to be called the 'Prince' and 'Princess.'" On February 9th a letter was read from Melling and Son, "requesting an advance of money on account of the 'Prince' engine now delivered, it was resolved that a payment of £1000 on account be made on the certificate of Mr. Trevithick." Which were these engines?

It has been stated that one of these early Crewe singles was exhibited at Darlington in 1875 under the name "Locomotion." Does Mr. Laidlaw know which? Were Nos. 65 to 72 2–4–0 or 0–4–2?

Finally, can he say anything about Nos. 123 and 127 (Peel), taken over from the Bolton Railway, and Nos. 177 to 184, which came from the North Union? Any information relative to the engines of the latter railway supplementing Whishaw and the Gauge Report would be welcome.

C. F. DENDY MARSHALL.

Guildford, June 14th.

THE "STABILOGRAPH."

SIR,—Although I did not write the article on the "Stabilograph," appearing in your issue of May 3rd, may I be permitted to comment upon Mr. Findlay's letter in your current issue?

An acceleration meter, consisting of a short period pendulum or liquid clinometer, operating under gravitational control, will measure the change of attitude, from the position of rest, of the moving body upon which it is placed when the acceleration is zero or when the velocity is constant. (There is an exception to this general statement when the indication of the meter due to the acceleration is of equal and opposite sign to the indication due to the angular change of attitude. This can seldom occur in a ship.)

In the circumstances cited a constant or steady indication of the meter gives the actual change of trim from rest due to the hydrodynamic pressures upon the self-propelled boat superposed upon any trimming effect due to the line of the propeller thrust lying above or below the centre of effort of the resistance. This change will in general be different from that of the non-self-propelled boat even when the line of thrust passes through the centre of resistance.

I think it will be found generally to be the case that normal types of surface vessel will trim by the stern when moving ahead unless the line of thrust lies above the centre of resistance.

T. B. ABELL.

Birkenhead, June 13th.

Canadian Engineering News.

(From our own Correspondent.)

Extension to the Queenston Power Plant.

THE Ontario Hydro-Electric Power Commission is preparing plans for the addition of a tenth unit to its great Queenston power development. Although originally designed for nine units, it has been demonstrated that there is a sufficient flow of water in the canal from Chippawa Creek to operate the extra unit, and the work is to be gone on with. The tenth unit will add 65,000 horse-power to the capacity of this huge power plant, and bring the total installed capacity up to 625,000 horse-power. The cost of the additional unit will be about 4,000,000 dollars. While no additional work will be required on the canal itself, it will possibly be necessary to enlarge the forebay on the north side and to put in an additional penstock.

When the right of way for the Chippawa–Queenston Canal was acquired, sufficient land was taken to permit the construction of a duplicate canal, should agreement with the United States sanction the addition. It is understood that the idea of enlargement has been abandoned by the engineers of the Hydro-Electric Power Commission, and if at any time a duplicate canal is built, it will be removed a short distance from the one now in operation.

A Portable Pneumatic Grinder.

The Canadian Ingersoll-Rand Company, Ltd., of Montreal, has developed a new portable pneumatic grinder known as the "Multi-Vane" grinder. Being light in weight and quiet in operation, these machines are said not to tire the operator, but to enable him to produce more work than he could with heavier machines. They are fitted with speed governors, which give power where it is wanted and yet keep the grinding wheel from operating at dangerous speeds, and by means of which the speed can be adjusted to any desired speed up to 6300 revolutions per minute. Grinding wheels of different diameters can therefore be driven by "Multi-Vane" grinders at their best cutting speeds. A rotor with four power vanes is used. It is made of steel, hardened and ground to reduce wear, and is a full floating fit on its arbor, to allow the rotor to align itself between its two end plates, so that no wearing pressure may come at the ends. An exhaust deflector, which also serves as a muffler, is used. The wheel end bearing comprises two radial thrust ball bearings, placed to take thrust from either direction, so that grinding can be done on either side of the wheel.

Alternating-current Electrolysis.

The recent very rapid development of hydro-electric power in Canada has made available in many places alternating-current at a price sufficiently low to justify its use in domestic water heating. Off-peak power is sometimes cheap enough to enable it to replace coal partly in central heating plants. Surplus power, developed by the large power companies in anticipation of future demands, is at present used on a large scale in raising steam for pulp and paper plants and is likely to be so used until it is required for purposes which can command a higher price. In view of these applications of alternating-current, it became evident to the National Research Council of Canada that the action of electric boilers should receive thorough study. The investigation has been carried on under the direction of Professor J. W. Shipley, of the University of Manitoba, and a report was made recently to the Research Council.

In previous reports on this investigation it has been pointed out that there is some danger of explosions from the generation of hydrogen and oxygen in boilers when the current is passed through the water as a resistor. This has been found particularly true with low-frequency current and at high current density. All of the current above a definite critical current density produces hydrogen and oxygen, the electrolysis following Faraday's law quantitatively, as in direct-current electrolysis. Electric boilers for steam generation operate at voltages up to 6600 or higher, and the investigation has therefore been extended to discover what decomposition of water takes place at voltages higherthan those used in domestic service This was particularly desirable, since hydrogen and oxygen have been found in radiators connected to a central heating plant. The fact has now been established that in addition to the electrolytic decomposition of water, when the critical current density is exceeded, decomposition also takes place owing to arcing on the electrodes. The quantity of hydrogen and oxygen produced by excessive arcing may be several times that which can be accounted for by electrolytic action. The critical point above which electrolytic gases are generated is also the point at which arcing begins. The conclusion has been reached by the investigators that the volume of the gaseous products of decomposition of water at high voltages is directly proportional to the quantities of electric energy used up.

Experiments were carried out at voltages from 700 to 2200, and in all cases the arcing, which was much in evidence at atmospheric pressure, disappeared entirely when the pressure was increased. A gauge pressure of 31 lb. per square inch entirely suppressed the arcing at 2200 volts.

Industrial Developments.

The International Nickel Company, of Canada, will shortly start work upon the construction of a chemical plant at Copper Cliff, Ontario, to manufacture nitre cake, a necessary flux in nickel refining. The new industry will use sulphur fumes from the company's smelter in the manufacture of the sulphuric acid necessary in the production of nitre cake.

The company's new smelter at Copper Cliff, since the original plans were completed, has been increased 60 per cent., and is being rushed to completion. The company's mines, smelters and refineries are operating to capacity, and additional facilities are being provided to meet the demand for nickel.

The Algoma Steel Company, subsidiary of the Lake Superior Corporation, has authorised important extensions and improvements to its plant at Sault Ste. Marie, Ontario. Both the merchant mills are to be extended so as to double their capacity in bars and structural shapes. When the extensions are completed, the mills will be adapted to the needs of the automobile trade, and will be the first mills in Canada designed to roll alloy steels. The extensions and improvements will mean the production of certain structural sections not now manufactured in Canada but used by the different fabricators. Such increased production has been found necessary on account of the activities of the different bridge companies in particular, and will very materially reduce importations of such materials from the United States mills. In addition to the mill development programme, improvements have been authorised necessitating large expenditures at the blast-furnaces and open-hearth departments.

A New Electric Furnace.

An electric furnace designed to produce a high-grade steel has been developed by Dr. E. H. Rothert, a Vancouver metallurgist, who is said to believe that his invention, which is the result of thirty-five years of research, will revolutionise the steel industry of the world. Dr. Rothert hopes, with the assistance of American capital, to have in operation at Vancouver, within a year, a steel plant capable of producing about 2,500,000 dollars' worth of steel per annum at the outset, and utilising the vast British Columbia magnetite iron ore deposits, which hitherto have been considered virtually useless for steel manufacture. It is stated that Dr. Rothert has specimens of his steel and steel products, as well as affidavits from leading engineers, technical experts and Government laboratories of the United States and Canada, to substantiate his claims that he has realised the dream of industrial chemists. Chief among an array of exhibits, made by the process and placed on exhibition in Vancouver recently, was a rivet set which had driven 116,000 flush rivets in the Ames shipyards of Seattle and showed, so it is reported, not even a scratch.

Railway and Road Matters.

THE new curve at Minster, on the Southern Railway, will be opened early in July. It will permit trains to run direct between the Dover and Deal and the Ramsgate and Margate branches.

THE Pennsylvania Railroad operates 183 dining cars on 200 trains daily, in which, on an average, 12,000 meals are served. Nearly 2000 persons are employed in connection with the dining car service.

SPEAKING recently at a meeting of railwaymen at Eastleigh, Mr. Maunsell, the Southern Railway chief mechanical engineer, said that he hoped to be able before very long to place an order for a very considerable amount of new carriage work at Eastleigh. He was very anxious, he added, to abolish a lot of the old coaches.

THE Southern Railway is introducing, as from July 8th, an express in each direction between Bournemouth and London that will cover the 108 miles in two hours. The train will leave Bournemouth at 8.40 a.m. and return from Waterloo at 4.30 p.m. A two-hour express will leave Waterloo at 10.30 a.m. and return at 5.15 p.m. for the summer months only.

OUR issues of March 8th and 22nd anticipated the announcement now officially made that the Wimbledon and Croydon branch and the line between Whitton Junction and Hounslow Junction at Hounslow and Windsor were to be converted to electric traction. To these, however, there must be included the line between Dartford and Gravesend Central. We would add that the Southern Railway report for 1928 budgeted a capital expenditure of £191,000 this year on electrification.

THE intimation that automatic signal control of the word traffic is to be installed along that portion of Oxford-street that lies between Marble Arch and Tottenham Court-road prompts the observation that such signals have been on trial for some time in Piccadilly. It should, however, be explained that the latter are not automatic but are operated solely by a police officer from a shelter at the top of St. James-street. What is now proposed are signals that work automatically at prearranged time limits.

THE Railway Rates Tribunal, as intimated in this column on April 19th, has, after the end of the first year since the "appointed day," received the charges in force and, after showing that the net revenue was £9,000,000 less than the standard revenue, reported that the above deficiencies were not due to lack of efficiency or economy in the management. That deficiencies not necessarily as large but substantial in character are likely to continue. That, nothing appearing upon our review which established that under present conditions any modification or modifications would enable the companies to earn their respective standard revenues, no such modifications are necessary, and we make none.

SEVERAL references have, from time to time, been made in this column to the economies which may be effected by railway signalling. Though less in evidence, there are many savings being made in telegraphs. As an illustration of what has been done in that direction abroad, it may be noted that, according to a paper by Mr. J. A. Webster, of the Entre Rios Railway, read at the Institution of Railway Signal Engineers on May 8th, the adoption of intercommunication between local telegraph services has so reduced the number of telegraphists necessary that £8000 a year have been saved in wages; the erection of 8448 kiloms of additional wire has been avoided; there has been less delay in the transit of messages; greater accuracy, owing to less handling of the messages; more intimate contact between headquarters and outlying districts; more efficient supervision.

IT is intended, so we understand, to despatch a formal invitation to British manufacturers of machines, materials and equipment for railways and roads, and motor cars, trucks and tractors, to participate in an Exhibition of Railways and Road Vehicles, which is to be held at Santiago from December 10th to December 31st next. Manufacturers wishing to participate should apply, forwarding a deposit of 50 pesos, to the Secretario-General, at the Offices of the Exhibition, 352, San Martin, Santiago, Chile. The charge for space in a covered building will be 25 pesos per square metre, and 10 pesos per square metre in the open. Foreign goods will be allowed to enter the country under a six months' free licence, customs charges being cancelled if articles are re-exported. A reduction of 50 per cent. will be allowed on all railway freight rates from any port to the capital. During the Exhibition, the Third South American Congress of Railways and Roads will be held at Santiago, and British co-operation in this is also invited.

FOR many years progressive use of electricity has been made by the railways of India for train lighting, workshop driving, welding, pumping, crane and capstan operation, and so forth, and perhaps the only recent application which, in view of its interesting nature, calls for record is the general application of electric headlights to steam locomotives. About 85 per cent. of the steam locomotives have so far been fitted, and the Railway Board is considering the advisability of making such headlights compulsory. The generator for the supply of the electrical energy must of necessity be situated on the locomotive itself, and it takes the form of a 32-volt, 500-watt steam turbine-driven set which is bracketed off the side of the boiler casing. There are several types with both alternating and direct-current generators, but the British product introduced a couple of years ago is a turbo-alternator of outstanding simplicity. A single-wheel steam turbine drives an inductor type of alternator, having a toothed rotor without windings of any sort and a stator consisting of permanent magnets with laminated pole tips carrying only two small fixed coils embedded therein. There is consequently no commutator or collector. The permanent magnets require re-magnetising at infrequent intervals, but electromagnets are provided for this purpose as part of the standard equipment. Only 250 watts, *i.e.*, half the output of the turbo-alternator, is taken by the actual headlight, the other half being applied for lighting the cab, gauges, lubricators and tender, while a portable lamp can be plugged in for inspection purposes.

Notes and Memoranda.

IT is proposed to dam the river Gento in Korea, and thereby to develop a useful hydraulic head of 900ft. This head will be utilised for the generation of some 5000 kW.

ACCORDING to a note in the *Far Eastern Review*, the cost of the 50,000-kW steam-driven power plant which the South Manchuria Railway proposes to put up at Anshan will be about £10 per kilowatt.

THE manufacture of Portland cement is receiving considerable attention in the Far East, and among the most recent announcements in this connection there are the starting of a factory at Ying Tak, Kwangtung, China, with an output of 1200 barrels a day, another in the Miye Prefecture of Japan to produce 100,000 barrels a month, and a third belonging to the Asano Cement Company with a capacity of 80,000 barrels a month.

IT is announced from Calcutta that Captain Foster, the mining engineer of the Ranee Gunge Coal Association, is responsible for the discovery that what is known in Indian coalfields as Jhama is in reality a natural metallurgical coke. It is calculated that there are about 25,000,000 tons of it fit for the market, and it is anticipated that Captain Foster's discovery may result in the overcoming of the difficulties in the way of using it, especially for the manufacture of Bessemer steel as well as the smelting of manganese ore.

IT is expected that there will be no emission of noxious fumes and dust from the new super-power station which is to be built at the Clarence Dock, Liverpool. The electrical engineer of the Liverpool Corporation, Mr. P. J. Robinson, designed a plant which, in the opinion of the City analyst, Professor Roberts, and Mr. F. G. Martin, a prominent Liverpool research chemist, will remove from the flue gases all noxious fumes such as sulphur dioxide, and will at the same time deal with dust and grit contained in these gases.

A MESSAGE from Cologne states that a mechanical letter-box which will automatically perform the duties of a post-office clerk is the invention of an engineer of that city. An unstamped letter or card is dropped through the appropriate slit into the box, where it falls on to a weighing apparatus. On a device at the top of the box is automatically registered the amount of postage required, which the sender, in coins, must place in the slot provided. The coins bring into action the "paid stamp" mechanism, and after the item is stamped, it is thrown into the container below.

THE Swedish State Telephone and Telegraph Department has added a new and important link in its network of international telephone connections by opening telephone communication with Italy, one of the longest telephone lines in Europe, measuring about 3000 kiloms.—about 1865 miles. The Swedes can now telephone to all countries in Europe, except the Soviet Republic and the Balkan States, and besides to the United States, Canada, Cuba, Mexico, Buenos Aires, and Ceuta in Africa. Sweden with its 6·1 million inhabitants now has 490,000 telephones, or 80 per 1000 persons, while the telephone lines have a total length of 860,000 kiloms.—say, 534,493 miles.

IN order to satisfy their needs of chromium, several Swedish ironworks have recently formed a syndicate to acquire an important chromium mine in Turkey. The property, which is situated at a distance of 150–180 miles from the coast in the vicinity of the railway between Stambul and Angora, has already been appropriated, and samples of the ore have been dispatched to Sweden. It is calculated that this mine can supply the Swedish needs for chromium for a considerable time ahead. In order to exploit the mine a company has been formed, the founders of which are the leading ironworks—Avesta, Sandviken, Hellefors, Uddeholm, Forsbacka, Fagersta, and Stroomsnaes.

THE destruction on May 3rd of Balsams dam, an earth dam at the head of the Mohawk River in New Hampshire, U.S.A., as reported in *Engineering News-Record*, May 9th, 1929, was caused by the failure of a coat of rip-rap to protect the downstream slope of the dam from erosion by water discharged through the spillway. Although this erosion had been going on for some time, it is stated that the immediate cause of the failure was the unusual amount of water passing through the spillway due to several days of heavy rain. It is also reported that there was a small leak through the bottom section of the dam, but as this had continued for years without perceptible increase, it is thought to have had no relation to the failure.

A NEW use for waste straw is being developed by a company incorporated in Regina for the manufacture of strawboard, which is intended to replace ordinary lumber in the construction of buildings, and one machine has recently been placed in operation. The patented product is called "Solomite," and patent rights for Canada have been acquired. The machine, it is stated, compresses the straw under a pressure of 100 lb. to the square inch, the product being laced with wire and turned out in boards 14ft. long by 5ft. wide and 2in. thick. A single machine turns out 4000 square feet of straw board per day, and it is contended that the product is fireproof on account of the pressure to which it is subjected, and that it possesses good insulating qualities.

IT has been shown by Baker that when an electric field is applied to benzene in a tube heated by an oil bath, the boiling point, as registered by a thermometer in the liquid, appears to be considerably raised. The same effect was later observed by Smits, who showed that the vapour pressure remains unchanged and that if the heating is carried out directly with a flame the liquid boils at the normal temperature. Smits attributed the phenomenon to superheating rendered possible by the removal of charged dust particles by the field. In the *Journal of the Chemical Society* for April, J. W. Smith describes experiments which show that the effect is very much reduced by vigorous agitation of the benzene, and when ebullition has commenced before the application of the electric field, then the boiling point remains unaltered. In all cases the vapour temperature has the normal value. The explanation advanced by Smits appears, therefore, to be correct.

Miscellanea.

A NEW shop, of three bays, for heavy engineering work has been started at Kilmarnock by Glenfield and Kennedy, Ltd.

A NUMBER of books which at one time formed part of Sir Isaac Newton's library are being offered for sale by Henry Sotheran, Ltd.

POWER transmission from the new plant which it is proposed to put up in the Briansk district of Russia is to be effected at a pressure of 110 kV.

IT is proposed to extend the plant at the Port Kembla power station, New South Wales, from its present capacity of 8100 kW up to an output of 25,000 kW.

A FACTORY for the production of synthetic acetic acid is to be put up in Japan at Ogaki, in the Gifa Prefecture. The expenditure is estimated at about £100,000 and the primary output is expected to be 10 tons a month.

ARRANGEMENTS are being made for the construction of a new pipe line and the addition of another 60,000 horse-power unit to the equipment of the power station at Cubato of the San Paulo Tramway Company, Brazil.

IT is reported that conversation by telephone between Berlin and Sydney was recently carried out experimentally by the Trans-Radio Company. The experiment was a great success, the voices at both ends being perfectly audible.

THE Donald Rose reservoir, constructed near Markinch to augment the water supply to Buckhaven, Methil, and surrounding rural areas, which has a capacity of 93 million gallons, has just been put in commission. Its cost was £121,000.

WE are informed that Sir Josiah Stamp has been invited and has agreed to accept the office of President of the Institute of Transport in succession to Air Vice-Marshal Sir Sefton Brancker, whose year of office expires on September 30th next.

ORDERS for two turbo-generators of 35,000 kVA capacity have been placed by the Sanyo Chuo Hydro-electric Company, of Japan. One of the machines is to be made by the Metropolitan Vickers Company and the other by the Mitsubishi Denki Company.

ESTIMATES which have been made show that the proposed bridge across the Yangtze River in China, from Hankow to Wuchang, will cost some £2,000,000. The proposed design includes room for a railway and for road traffic, and would involve fifty spans.

IT is reported that the construction of the power plant on the Indal River, Sweden, to exploit the Kraangede Rapids is to begin in 1932 and is to be completed in 1936. The total cost of the undertaking is estimated at Kr. 14,000,000. The plant will have an initial capacity of 50,000 kW, but it is possible that it will be extended to 150,000 kW.

ACCORDING to present arrangements, it is understood that the new North German Lloyd liner "Bremen" will leave her fitting-out berth at the Deschimagwerft A.G., Weser, on June 23rd, and will proceed the following day or the day after that to Bremerhaven. After a short machinery trial at sea the new liner will return to Bremerhaven, and on the 28th or 29th inst. set out for Southampton, where she will be dry docked on July 1st. After docking, a three days' builder's trial is to take place, probably towards the Norwegian coast, after which the ship will be taken over and return to Bremerhaven to prepare for her maiden voyage on July 16th.

FROM the monthly returns of the National Federation of Iron and Steel Manufacturers, we learn that the number of furnaces in blast at the end of May was 159, a net increase of seven since the beginning of the month, eight furnaces having been blown in and one having ceased operations. The production of pig iron in May amounted to 654,800 tons, compared with 611,300 tons in April and 591,500 tons in May, 1928. The production includes 203,400 tons of hematite, 285,800 tons of basic, 119,300 tons of foundry, and 22,200 tons of forge pig iron. The May output of steel ingots and castings amounted to 840,400 tons, compared with 808,600 tons in April and 752,700 tons in May, 1928.

THE Montreal Harbour Commission will during the next three years expend a total amount of 10,000,000 dollars in harbour improvements, rendered necessary by the greatly increased traffic of that port. The principal details are as follows:—Enlargement of Laurier Pier, 2,000,000 dollars; reconstruction of King Edward Pier and Alexander, 2,000,000 dollars; extension of the electrified railway across the Lachine Canal, 1,500,000 dollars; extension of the grain conveyor system, 1,000,000 dollars; industrial wharves, 500,000 dollars; additional berthing facilities, first stage, 2,000,000 dollars; acquisition of land, 1,000,000 dollars. The grain exports from Montreal last year totalled 211,000,000 bushels, as compared with 84,000,000 bushels from New York.

ACCORDING to reports received from State mine inspectors by the United States Bureau of Mines, the accidents in the coal-mining industry of the United States in April, 1929, resulted in the death of 135 men; 99 occurring in bituminous mines and 36 in the anthracite mines of Pennsylvania. During the first four months of 1929, 668 men lost their lives in coal mines. The production of coals during those months was 200,454,000 tons, resulting in a death-rate of 3·33 per million tons. The bituminous rate was 2·97, based on 520 deaths and 174,962,000 tons of coal; that for anthracite was 5·81 based on 148 deaths and 25,492,000 tons. For the same period in 1928 the rate for bituminous mines alone was 3·02, with a production of 161,702,000 tons and 489 deaths. The rate for anthracite was 6·08, based on 23,678,000 tons and 144 deaths; while the death-rate for the industry as a whole was 3·41, based on 185,380,000 tons and 633 deaths. A comparison of the accident record for the first four months of 1929 with that for the same period of 1928 shows a reduction in the death-rate for falls of roof and coal, gas or dust explosions, explosives, and electricity, and a slight increase in the haulage rate.

CASCADE TUNNEL: GREAT NORTHERN RAILWAY, U.S.A.

(*For description see page 672*)

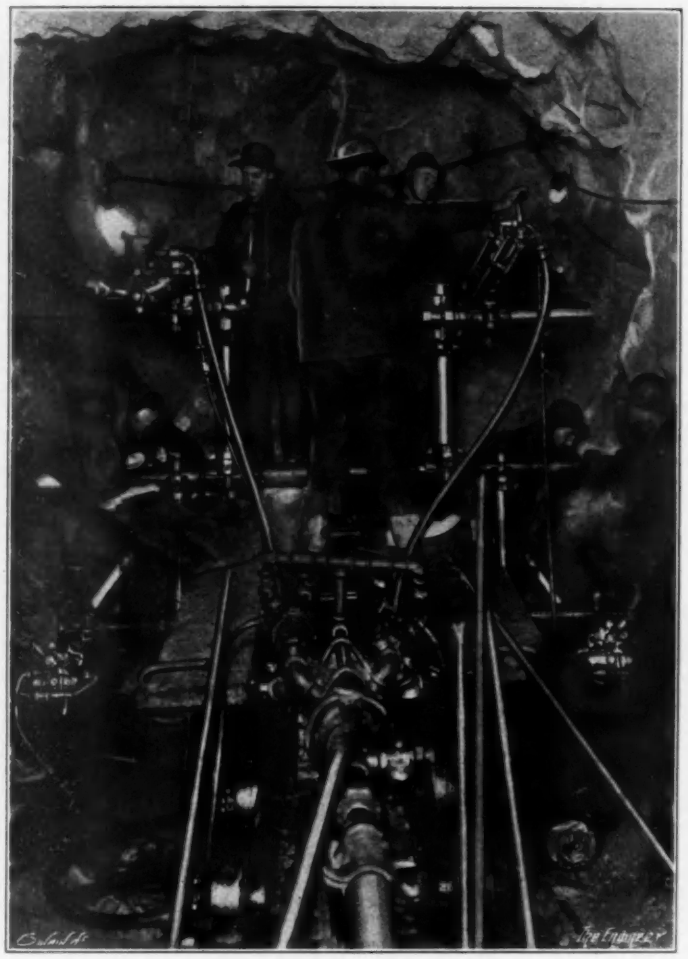

FIG. 15—DRILL-CARRIAGE AT HEADING

FIG. 16—MOVING STEEL FORMS FOR TUNNEL LINING

FIG. 17—EXCAVATOR LOADING ROCK IN TUNNEL ENLARGEMENT

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DEATH.

ON June 17th, 1929, SIR JULIAN WALTER ORDE, Knt., for twenty years Secretary of the Royal Automobile Club, aged sixty-eight.

THE ENGINEER.

JUNE 21, 1929.

Naval Disarmament Prospects.

WE offer no apology for returning this week to the subject of Anglo-American naval armaments. It is a subject which we have always regarded as having a crucial bearing not only on the future of the British Empire, but on the peace of mankind. Unless this country and the great republic across the Atlantic agree to live on terms of complete amity and mutual trust, it will be futile to look for any permanent improvement in the general political situation of the world. Alike in the conduct of international and private affairs, men are judged more by their deeds than their words. In both cases example is better than precept. British and American statesmen are prone to censure other States which maintain what seem to be needlessly swollen armaments, and they join in deprecating the survivial of the old antagonisms that turned Europe into an armed camp. Yet to all such homilies the delinquent States have had, up to now, an effective retort. Why upbraid us, they ask, for the very sin of which you yourselves are guilty? It is certainly anomalous to lecture Continental Powers for maintaining competitive armaments when at the same time Great Britain and the United States are rivals in the naval sphere. All who follow the continental newspapers will be only too familiar with the satirical and very frank comments that are passed upon "Anglo-Saxon hypocrisy" in this connection. If the English-speaking peoples intend to organise a crusade for world disarmament and peace they must obviously begin by eliminating every semblance of armament rivalry between themselves. That this necessity has become apparent is indicated by the trend of events. Both in London and Washington the new heads of State are concentrating on the naval problem. Shortly after entering the White House President Hoover, through his representative at Geneva, made a determined effort to end the deadlock which had persisted since the failure of the Geneva Three-Power Conference of 1927. The United States, it was announced, was prepared to waive its objection to the "global" system of tonnage computation, and, moreover, was resolved to approach the whole question of relative strength afloat on the basis that the negotiating States "are going to be friends and settle their differences in a friendly spirit."

This fraternal gesture met with a cordial response in Great Britain, where its significance was fully appreciated. Then came the General Election here. All three parties went to the polls pledged to further the cause of disarmament, and it is our conviction that this pledge would have been honoured even though the election had had a different result. Be that as it may, the new Prime Minister, as he reminded us in his speech at Lossiemouth on Monday, "made it clear, both before and during the election, that he put our relations with the United States in the forefront of our national concerns." Meanwhile, President Hoover had appointed as Ambassador to London a man who, though he modestly disclaims experience in the diplomatic art, yet commands world-wide confidence and esteem. As chairman of the Experts' Committee which did so much to solve the obstinate problem of reparations, General Dawes has already gained a permanent place in history. The qualities of statesmanship, reinforced by a penetrating judgment and an iron determination to get things done, which he exhibited on that occasion, are the very attributes most needed in the treatment of the less thorny though still difficult problem that now awaits him. His early visit to the Prime Minister at Forres, undertaken regardless of personal convenience, is proof positive of the new Ambassador's desire for quick action in regard to the naval question. At the Pilgrims' dinner in London on Tuesday he gave a general though necessarily non-detailed exposition of the situation. Premising that "the question of an early agreement on naval reduction by the nations is of outstanding importance at the present time, and would seem to be the next step to be taken towards world peace," he went on to explain both the political and economic consequences of naval shipbuilding unchecked by international agreements. Congress, he pointed out, has already committed the United States to an immediate naval programme involving over £50,000,000—"giving, however, to the President the power to suspend it in the event of an international agreement for the limitation of naval armament." He also quoted from a striking statement by Mr. Stimson, the U.S. Secretary of State, on May 31st, to the effect that the cost of new American warships authorised and contemplated amounts to a figure not less than £234,160,000. Mr. Stimson candidly admitted that if this programme poceeded other nations would be impelled to follow suit. That is quite true, and, in the event, the United States could not escape the responsibility of having initiated a new building race. It has, however, been made clear that her wish is to deflate naval armaments, not to expand them, always provided that her claim to naval equality is upheld in principle and in fact. Great Britain, on her part, concedes this claim with only a single reservation, namely, that any scheme of reduction shall leave her with a fleet of sufficient strength to afford reasonable security to the floating trade upon which her very life depends. Since battleship equality is already established by Treaty, it only remains to determine the common standard of strength in lighter craft, of which cruisers are the most important. This is where the new American "yardstick" is expected to prove useful. Just what the new formula is remains a secret for the present, but from unofficial forecasts, it appears to represent an honest attempt by American experts to meet the British objections to a rigid scale of cruiser tonnage. America has decided that she needs none but cruisers of the largest size and heaviest guns. The British Empire, with very different problems of strategy to face, insists on numbers rather than individual size. Previous negotiations have failed because of the difficulty of finding a formula that would adjust these conflicting needs without departing from the root principle of parity. Now, however, the American "yardstick" is to come into play. According to *The Times* correspondent in Washington, who is careful to say that his information is quite unofficial, the United States will propose that two 6000-ton cruisers with 6in. guns

be considered as equivalent, for the purpose of treaty computation, to one 10,000-ton cruiser with 8in. guns. Application of this formula to the probable future organisation of the two cruiser fleets—one composed exclusively of heavy ships, the other containing both heavy and light vessels—might give the United States an aggregate of 300,000 tons, as compared with a British Empire total of 350,000. It seems to us not an unfair method of grading the two fleets, though we are not surprised to learn that it is being roundly condemned by the super-navy enthusiasts in the United States. General Dawes, in his speech on Monday, drew a shrewd distinction between the respective functions of the statesman and the expert at international conferences. Two sentences stand out pre-eminently: "Other things being equal, I fear no naval officer ever inherently favours equality." And again: "I will say, frankly, that from a commission of naval experts of the respective nations meeting together and called to evolve a final definition of the naval 'yardstick,' I personally should expect a failure to agree." We are very much afraid that the General's misgivings would be justified. It is not that the naval expert is opposed in principle to disarmament, or that he seeks to gain an unfair advantage over the other side, but simply because, as the Ambassador puts it, he remembers that his first duty is to secure his country against attack, and he therefore trusts primarily to his ships and his guns.

But the duty of the statesman, in contrast to that of the expert, is "to remove from his State the danger of attack." No definition could be more lucid. We take it to mean that the American Government will not permit expert objections to stand in the way of a new naval reduction pact. It is perfectly certain that our own Government intends to co-operate in the like spirit. And each Government has at its back a tremendous weight of public opinion, favouring the retrenchment of armaments and the establishment of Anglo-American friendship on an enduring basis. With such an atmosphere prevailing, it will be strange indeed if the negotiations now in sight are not brought to a happy issue. We shall, no doubt, be called upon to yield some measure of our existing naval power, but it is clear that America, for her part, is ready to cancel many of her projected ships for the sake of reaching an agreement with us. The sole danger we can perceive is that the statesmen of both countries, in their praiseworthy zeal for the cause, may adopt a common standard of naval strength which is below the bottom level of safety. That is a risk which America, self-supporting and geographically remote as she is, could accept much more lightly than Great Britain, to whom, and to whose Empire, sea trade is veritable life blood. We shall, however, be very much astonished if the American reduction formula proves to be in any respect unreasonable, one-sided, or incompatible with the minimum requirements of Britain's naval security.

The Formation of Scale in Boilers.

THE most troublesome of all the scale-forming constituents of feed-water is undoubtedly calcium sulphate. Sulphate scale is a hard, dense deposit almost like porcelain; it is particularly difficult to remove from the metal surfaces, and is probably responsible for more bent, blistered or burst tubes than all other causes put together. The presence of calcium sulphate also renders other deposits more dangerous, for those that would be porous or friable by themselves are entangled by its needle-like crystals and consolidated into a hard layer capable of giving more trouble than either deposit singly. The importance of calcium sulphate as an impurity of feed-water has led to numerous studies of its nature and effects. Three forms of it are found in boiler-scale, ranging from gypsum with two molecules of water of crystallisation to the anhydrous salt with none. All three forms produce deposits which are essentially similar. The first two, however, are associated with temperatures lower than those met with in modern steam practice, and as they both tend with time to pass automatically into the anhydrite, the latter alone is of practical importance to boiler users. All forms of calcium sulphate are thrown rapidly out of solution as the temperature rises, water which can hold about 650 parts of the anhydrite per million at atmospheric boiling temperature depositing as much as 91·5 per cent. of the salt by the time a temperature of 220 deg. Cent., or a boiler pressure of about 320 lb. per square inch is reached.

Two theories have been advanced as to the way in which the sulphate is deposited. According to one belief, as soon as the water reaches its limit of saturation, the salt comes out of solution in the form of minute particles distributed through the mass of the water, which eventually attach themselves to the heating surfaces and build up a thickness of scale. This, which may be called the colloid theory, has given rise to various attempts to prevent scale either by maintaining an electric potential tending to oppose the contact of the charged particles with the metal, or by adding other colloidal solutions with the idea of preventing the sulphate particles sticking together or to the metal surfaces. The alternative theory, which is that the scale is formed in position, appears to have been definitely established by Dr. E. P. Partridge and Professor A. H. White, who have embodied the results of some very interesting experiments in a paper contributed to the monthly journal of the A.S.M.E. By examining microscopically the highly polished surface of a metal plate through which heat was being transmitted to water containing calcium sulphate in solution, it became evident that scale always started as a fine ring of minute crystals, marking the place where a bubble had been detached. From these rings needle-crystals grew outwards into the solution, became interlaced with similar crystals from adjacent rings, and so on until the whole surface was covered with a crystalline deposit. Experiments with air and other gases in solution, which were liberated as bubbles before the boiling point was reached, confirmed the view that a bubble of any kind was sufficient to start deposition, though in boiler practice steam bubbles alone need be taken into account. According to the views of the authors the mechanism of scale formation in steam boilers is somewhat as follows:—When boiling temperature is reached the film of water next to the heated metal begins to vaporise at some point. The surface under the vapour then becomes hotter still, owing to the insulating effect of the vapour. This local overheating causes the film of solution surrounding the dry spot to be evaporated, the bubble therefore growing until it becomes detached from the metal by its own buoyancy. When such a process takes place in a saturated solution of calcium sulphate, the fluid film at the edge of the dry spot becomes supersaturated by the increase of temperature, and is forced to deposit minute crystals in the ring where metal, vapour and water meet. These crystals are always in contact with a supersaturated solution, first on account of the evaporation of pure water into the bubble; and secondly, by the return of liquid now supersaturated, after the departure of the bubble. They thus tend to grow continuously as long as heat enters the solution through the metal.

If this view is correct—and the experiments of Messrs. Partridge and White seem to leave little room for doubt about it—the colloidal theory is untenable, and electrical methods of preventing scale are founded on false premises. Many processes work, however, in spite of their theory being wrong, and investigations into electrical methods are being proceeded with. So far the laboratory results have been negative, the systems tried having no effect in stopping or decreasing the rate of deposition of scale. With regard to the use of colloidal solutions as scale preventers matters seem more hopeful. The authors found that several of them were adsorbed on the calcium sulphate crystals after the latter were formed on the metal, and strongly modified the physical characteristics of the scale. In some cases, indeed, the scale became so weak as to flake off the metal surfaces under the action of convection currents. It appeared probable, therefore, that some colloids might be beneficial in minimising scale troubles, even though the theory advanced in support of their use was inaccurate. Another point also seems to have been cleared up, namely, the effect of the nature of the metal surfaces in respect of scale deposition. Suggestions have been made that scale would not form on evaporative surfaces of particular metals. Messrs Partridge and White have, however, produced exactly similar scales under similar conditions upon surfaces of polished steel, oxidised steel, chromium, silver, nickel, and glass. They also discovered incidentally that in no case did calcium sulphate by itself produce a scale which appeared to be bonded to any degree to the surface on which it had formed. The scales invariably cracked off cleanly. The adherence of calcium sulphate scale, which is so strongly marked in practice, is thought to be a bonding effect due to the roughness of the tube surface and the mechanical strength of the scale.

If we are to accept the authors' theory that scale only starts at points where bubbles are formed, there follows an interesting consequence which has escaped their attention. When steam is generated by heating water at a pressure above the critical, as in the Benson boiler, no bubbles are or can be formed. Hence, if the theory is correct, no scale could be formed in a Benson boiler. Any calcium sulphate present would, however, have to be thrown out of solution at the high temperature of the water, so that it must either pass out in the steam as dust or remain in the boiler in the same form. There are few boilers working above the critical pressure in existence, and in such as there are it is probable that nothing but distilled water is used as feed, so that experience is wanting as to whether scale can be formed in them or not. If it can be the bubble theory would seem at least incomplete, while if it can not, then the type of boiler in question has at least one inestimable advantage over ordinary steam generators. The difference between the point of view of a laboratory and a boiler-house is shown rather strikingly by the discussion by the authors of the rate of formation of scale. They reason that as the quantity of calcium sulphate which water can hold diminishes rapidly with the temperature of the water and therefore with the pressure of the steam, a boiler working at high pressure will make less scale than if the pressure were lower. In support of this contention they quote experimental figures showing that with a constant rate of heat transference a boiler which deposits 0·320 lb. of scale per square foot per day at 10 lb. pressure, deposits scale at only one-tenth of this rate at 50 lb. pressure, and at only 0·010 lb. per square foot per day at 150 lb. pressure. This may all be perfectly correct, for it is certainly true that when a boiler is evaporating water which can only hold a small quantity of sulphate in solution, the scale deposited per pound of water evaporated will be less than if the water held more sulphate. Engineers, however, look at the question in a different and more practical way. To them the sulphate contents of the feed-water is the only criterion of sulphate scale-formation, for it is clear that all the sulphate entering the boiler must be left there, entirely regardless of the pressure at which the boiler may be working. If the pressure is low the density of the water will be greater, but once the saturation limit is reached at any pressure, the sulphate will begin to come down as scale and will continue to do so at exactly the rate at which it is renewed by the feed.

The experiments quoted would seem to have been made under conditions in which the boiler was always fed with water at the steam temperature, the feed therefore carrying much less sulphate per pound of water at the higher pressures. In practice boilers are never fed at steam temperatures, so that the apparently obvious conclusion from the experiments that scale troubles are reduced with higher working pressures is as unjustified as it is contrary to experience. As regards the effect of scale on heat transference, the authors incline to the view that the losses in boiler efficiency owing to scale have been greatly exaggerated. They quote Eberle and Reutlinger as saying that their experiments showed that an ordinary scale averaging 0·22in. in thickness influences the efficiency of a boiler so little that the effect cannot be determined by comparative boiler tests. With scales of medium conductivity, 0·2in. thick, the loss of efficiency is considered to be only 2 or 3 per cent. In this connection it may be remarked that Messrs. Partridge and White found by experiment that the average coefficient of heat conductivity of calcium sulphate scale lay between 1 and 2 B.Th.U's per square foot per hour per deg. Fah. Although overall boiler efficiency may not be appreciably lowered by a moderate amount of scale, the overheating of the tubes may easily become serious. Taking the heat conductivity coefficient of sulphate scale at its average value of 1·5, a deposit only one hundredth of an inch thick will raise the temperature of a tube by about 5·6 deg. Fah. for every 10,000 B.Th.U's per square foot per hour transmitted through the metal. With a heat transfer rate of 70,000 B.Th.U's per square foot per hour, which is easily attained in tubes exposed to furnace radiation, a sulphate scale 0·1in. thick would raise the temperature of a boiler tube working at 150 lb. gauge pressure to 753 deg. Fah. The same temperature would result from 0·07in. of scale at 600 lb. pressure, and 0·04in. at 1500 lb., the rate of heat transfer being maintained at 70,000 B.Th.U's per square foot per hour. As scales of lower conductivity would, of course, increase the tube temperatures, it is clear how little margin there is for scale in water-wall and similar tubes exposed to the intense radiant heat of a furnace.

Resistance of Concrete to Sea Water.

By H. E. SQUIRE.

THE following article on "The Resistance of Concrete to Sea Water," which is from the pen of Mr. H. E. Squire, who is Assistant Harbour Engineer, Board of State Harbour Commissioners, San Francisco, is reprinted from the issue of June 4th of our contemporary, the *Canadian Engineer*.

Marine structures are subjected to varying degrees of accelerated weathering. Not only are they immersed in the saline solutions of the sea, but in addition they are subjected to severe mechanical abuse which aids the searching sea water attack in uncovering every defect of design and construction. The impinging blows of waves, the repeated wetting and drying of spray, the alternating exposure and covering of surfaces by the tide, the impact of drift impelled by current, the cutting effect of sand, the racking blows of heavy ships—all this mechanical wear and tear acting in conjunction with strong electrolytes of the sea produces a condition where erosion and deterioration is the natural order of things. In fact, the destructive effect of the mechanical abuse and the mechanical application of the sea water is so variable that the chemical effect of sea water exposure is largely obscured. The failure to recognise this wide variation in exposure has resulted in confusion in the study of the subject, and to seeming contradictions in the discussion of it.

DETERIORATING EFFECT OF SEA WATER.

Irrespective of degree of exposure the deteriorating effect of sea water on concrete structures manifests itself in two general ways :—

First, in the retrogression and breaking down of the concrete itself as manifested by softening, cracking and progressive peeling of surfaces. These phenomena are usually attributed to chemical changes in the set cement and to the leaching out of slightly soluble ingredients. Calcium hydrate in the interior mass of the concrete is usually considered the offending constituent on account of its solubility and its tendency to react with sulphate solutions in the sea water.

Second, in the cracking and spalling of the concrete resulting from the corrosion and expansion of embedded steel reinforcement. In contrast to the behaviour of reinforced concrete under atmospheric exposure, this phenomenon is attributed to the stronger electrolytes of the sea and to the fact that most of them are unaffected by the concrete, whereas the common electrolyte of the air, carbonic acid, reacts with and is neutralised by the calcium hydrate of the set concrete.

The first type of deterioration is confined to portions of the structure actually immersed, or from the tide line down. As a coincidence the second type or that due to corrosion of the steel affects only that portion above the water of from the mean tide up. Apparently there is insufficient circulation of oxygen in the water to support rapid corrosion.

EXCLUSION OF WATER AND AIR.

The durability of concrete structures in resisting these attacks is dependent quite as much on design as on quality of concrete. Nevertheless the design must be predicated upon the use of a suitable concrete. As the exclusion of water and air from the interior mass is of paramount importance, the most desirable property of sea water exposed concrete is resistance to the absorption and circulation of water. Of equal importance is uniformity in the quality of the concrete. Sea air and water are impartial in their attack and any defect or weakness is inexorably disclosed. In this respect a structure in which stability and life depend primarily on resistance to weathering differs from one dependent on resistance to loadings and stresses. A healthy factor of safety may protect the latter against great fluctuations in quality of concrete. But in the former case the action is cumulative ; the weaker portions not only yield progressively but they act as foci opening the way for attack on more resistant material. No factor of safety will prevent the sea water from attacking an 800 lb. per square inch layer of laitance and sand which might last indefinitely in ordinary structural designs.

HIGH CEMENT CONTENT ESSENTIAL.

Compressive strength is generally accepted as the criterion for measuring quality. But while highly non-absorbent concrete shows a reasonably high strength it does not follow that high strength concretes are inherently the most suitable for sea water work. This is particularly true where strength is achieved by reducing the water content or by increasing the size or quantity of rock to such an extent that the mix becomes harsh or "tricky." Resistance to absorption is greatly affected by the cement content itself and a reasonably high cement content is an essential requirement for sea water resistance concrete, whether located below or above the water line. Experience and experiments with briquettes stored in sea water for fifteen years have indicated no retrogression in mortars proportioned one to one and one-half where the sand was given a variable grading up to ten mesh maximum. With well-graded aggregates up to 1½in. maximum, proportioned after the manner of Fuller's curve, a satisfactory concrete can be obtained with a cement content of one to five parts total aggregate. This ratio of cement to total aggregate should be increased when smaller maximum size or other peculiarities of grading require an increased mortar content.

MUSHY CONSISTENCY PREFERRED.

The period of excessively wet mixes is happily passed, and to-day anyone advocating the use of water is liable to lose caste. Nevertheless sufficient water should be used to produce a mushy consistency still having the necessary stickiness to prevent separation during delivery. On our work a fixed consistency is not specified nor required, but the water is varied slightly to suit the peculiarities of the pouring. Measured by the slump test, the consistency ranges around 3in. to 5in., and the concrete gives a twenty-eight-day strength of about 2500 lb. The vogue of producing high strengths by employing harsh mixes of low water content in marine structures is almost as dangerous as that which preceded it—of flooding the concrete until it flattened into place without tamping. The use of mushier mixes with the sacrifice of some strength to uniformity is preferable.

SELECTION OF AGGREGATES.

Aggregates for sea water resistant concrete should obviously be inert to sea water reaction and be composed of non-absorbent material. But in addition they should be selected with a view to producing uniformity when delivered to the forms. The use of aggregates which have a tendency to separate owing to grading, shape or nature of particles should be avoided, and within reasonable limits the several sizes in which the aggregate is delivered and measured should hold their grading without fluctuation. Gravels segregated by washing over screens are generally preferable to crushed rocks which are screened dry and contain varying accumulations of rock dust. The accumulations of fines are particularly annoying, as they materially change the cement content of the mortar. On the other hand, the practice of adding a small fixed quantity of rock dust, fine sand or diatomaceous earth to produce stickiness and increase uniformity is beneficial if carefully regulated. The use of hydrated lime for this purpose is not desirable in sea water concrete as the calcium hydrate is not inert.

MANIPULATION IMPORTANT FACTOR.

The manipulation of the plastic mass after mixing is as much a factor in the producing of a uniformly resistant concrete as the selection and proportioning of the various constituents. In fact, it is possibly the more important factor, as the larger part of the technologists' work consists in selecting and proportioning ingredients with a view to facilitating manipulation. At any rate, faulty mixes and consistencies may frequently be corrected by laborious care in placing, but no amount of technical skill in selection of materials and proportioning can offset indifferent handling after mixing. The segregation of mortar and aggregate during depositing and the failure properly to compact the plastic concrete account for most of the defects observable where the concrete itself has failed in sea water. In order to ensure careful placing it is our practice to specify the number of tampers in terms of yards of concrete placed per hour—ordinarily one tamper to two yards per hour. These men are employed solely in agitating and compacting the concrete, and the consistency is adjusted to the tamping specified. The delivery of concrete faster than it can be compacted needs to be guarded against, and for this purpose delivery in containers is preferable to delivery in chutes, as each dump can be held back until the previous deposit is properly placed.

OBJECTIONABLE CONSTRUCTION PRECEDENT.

Construction methods which require speed, driving or other pressure on the men should be avoided. These conditions result from the use of risky cofferdams, working between tides and other methods which are inherently defective. The rapid placing of long vertical depths is objectionable, as it is impossible to regulate the accumulation of water or to force out the entrained air and water. But the most objectionable of all construction methods is the placing of concrete under water. When enclosed in a protecting skin of steel or precast concrete, such concrete may be relied upon for sealing and for low compressive stresses, but such concrete should not be relied upon to resist sea water weathering on account of the variability of the product.

PRECAST CONCRETE PREFERABLE.

In contrast with the objectionable construction expedients cited, the precasting of members is particularly desirable because of the greater facility with which the plastic concrete can be placed and the greater uniformity of the product. The atmospheric exposure of surface is beneficial, as the calcium hydrate of the immediate surface is changed to the carbonate, which is inert in sea water. In good concrete, however, this skin is exceedingly slight and the great advantage of precast concrete lies in the improved quality and uniformity of the entire mass, rather than in the surface treatment.

Portland cement concrete proportioned as described and placed with the precautions indicated is satisfactory for sea water work. Such concrete will have a total absorption of from 4 to 5 per cent. by weight after drying in an oven, which resistance appears sufficient to prevent injurious circulation of water after immersion. It has been our custom to increase the fineness of grinding of the cement and to limit the magnesia content to 3 per cent., but there is no actual proof that these changes from the standard specifications are essential.

But while concrete of this quality is of itself resistant it cannot be relied upon to protect steel embedded at depths used in ordinary reinforced concrete construction against the corrosive action of sea water. At depths of from 4in. to 6in. a protection equivalent to the durability of the concrete itself may be obtained, but such depths of embedment preclude the use of reinforced concrete as it is ordinarily designed.

LIFE OF REINFORCED CONCRETE.

On the other hand, the damage resulting from this type of deterioration is generally exaggerated. In the first place, corrosion of steel accompanied by swelling and cracking does not occur below the water line, so that the damage is limited to the accessible parts of the structure. In the second place, the damage is confined to the outside shell of weatherproofing concrete. In good concrete and under ordinary exposure it makes its appearance as an occasional crack after eight or ten years, but does not seriously affect the stability of the structure under twenty to twenty-five years. Consequently the reinforced concrete structure as ordinarily designed and under average intensity of exposure may be expected to give a service life of twenty-five years without extensive repairs. Expedients for improving the ordinary design should therefore be measured by this yard stick. In spite of the idealistic appeal of permanence, the earning value of expenditures should control engineering design. With interest figured at 5 per cent. per annum, the present worth of a fund for replacing the structure in twenty-five years is less than 30 per cent. of the first cost, and absolute permanence as compared with an assured life of twenty-five years is worth an additional first cost of about 42 per cent. Since marine structures of reinforced concrete comparable in purpose and capacity are showing differences in cost of several hundred per cent., it is evident that many designers are expending more than is warranted in seeking that will-o'-the-wisp, permanence.

PROLONGING LIFE OF CONCRETE.

Expedients for prolonging the service life of reinforced structures may be grouped according to method of protecting the steel.

First, are the expedients of design intended better to utilise the protective value of the concrete itself. The increased embedment of the steel over that adopted in ordinary weatherproofing is, of course, the basis of these efforts. The pressure exerted by small diameter bars is less than that of large bars, and the spalling can be greatly reduced and possibly prevented by reducing the diameter of the bars used. In our practice the clear covering is made at least three diameters of the bar for exposure above the water line. Beams and girders are particularly susceptible to cracking on account of the heavy concentration of bottom steel and the angular shape, whereas slabs and smooth surfaces are more resistant. In addition, flat slabs and one-way slabs with wide shallow beams are designed with the heaviest steel concentrations at the upper side of the deck. Increased protection may be accomplished by bending in or splicing the steel where it is not required, as in the upper ends of piles above the water line. The cracking of the protective coating under occasional high stresses offers ingress to air and water and can be reduced by carrying impacts of ships axially by means of piles or other members instead of relying on the straining of the structure in bending.

Second, are the expedients which seek to seal the concrete against the absorption and circulation of water and air. It appears impossible to accomplish this merely by improving the quality of the concrete. Surface coatings obviously offer a simple method, and for this purpose asphaltic compounds having sufficient viscosity to heal over cracks and adequate thickness to exclude air and moisture have proved satisfactory. An uncut asphalt livened with 10 per cent. China wood oil and applied hot is used in our practice. A more elaborate process of treating by immersion in asphalt and injection under heat and pressure has also been developed, but it has the disadvantage not only of greatly increased cost, but also of non-applicability to the deck structure, which is most vulnerable to disintegration from corroding reinforcement.

Third, are the expedients intended to protect the steel directly either by sealing and insulating it or by coating it with a more resistant material. Paints and lacquers proposed have for the most part been rejected because of their deleterious effect on bond. The encasement in metallic coatings, particularly zinc, reduces the bond slightly and does not prevent electrolytic action, but the products of the corrosion of zinc appear to diffuse through the interstices of the mortar without creating the pressure produced by the corrosion of iron. The use of galvanised reinforcement is increasing commercially and so far has proved successful. The recent introduction of cadmium as a coating may also prove successful. Both zinc and cadmium are electro-positive to iron and consequently retard corrosion, whereas metallic coatings which are electro-negative are undesirable and are known to accelerate corrosion.

Many variations of these preservative expedients are in use, and structures constructed to-day give promise of greatly outlasting the earlier reinforced structures of twenty years ago. The advisability of resorting to them is largely a problem of the economics of design.

In summarising the present status of the art as applied to sea water exposed construction, it may be stated with assurance that the methods of ordinary good practice will produce a concrete so durable in sea water that for the engineer's purposes it can be considered permanent. Durability is obtained not through the chemical inertness of the cement itself, but through the mechanical resistance of the concrete to the circulation of sea water in the interior mass. It is possible that little more can be effected by the engineering technologist through his proportioning and manipulation of the concrete, but it is probable that much may be accomplished by the chemist in producing a cement less susceptible to chemical change in contact with sulphate solutions, or of a blended cement in which ingredients like ground puzzolan are introduced to react with and render inert ingredients affected by sea water. But in view of the satisfactory results achieved with the present standardised Portland cement, such development will be advantageous only in allowing the use of poorer mixes and in offsetting the results of poor workmanship.

The same assurance cannot be expressed in regard to the durability of reinforced concrete. A great deal remains to be effected by the engineer ; first, in frankly acknowledging the limitations of concrete in protecting steel exposed to the electrolytes of the sea, and then in educating owners to the necessity of maintaining these structures by periodic painting and occasional repairs. No obloquy is attached to structural steel bridge construction because of maintenance against corrosion by regular inspection and painting. The advisability of similar treatment for reinforced structures is not obvious because engineers and owners have come to regard concrete itself as a reliable protection for steel. Nevertheless, maintenance by painting with impervious coatings offers an inexpensive and reliable means of prolonging indefinitely the life of reinforced structures exposed to sea water. Progress in constructing more resistant reinforced structures must come in large part from the metallurgist in developing non-corrosive coatings for the steel. The galvanising of reinforcement is being justified with increased use, and the development on a commercial scale of metallic coatings gives more promise of solving this problem than the possibility of securing absolute protection from the concrete itself.

OUT of a total of 3352 locomotives working passenger and mixed trains in India, 2785 had been equipped with electric headlights at the end of March, 1928. The annual report of the Railway Board in mentioning the fact states that the advisability of making the provision of electric headlights compulsory on all train engines was then under consideration.

North-East Coast Exhibition.

No. VI.*

OUR description of the machinery and apparatus shown in the Palace of Engineering at the North-East Coast Exhibition, Newcastle-on-Tyne, is continued below.

M. W. SWINBURNE AND SONS, LTD.

An interesting exhibit which is displayed on the stand of M. W. Swinburne and Sons, Ltd., of Wallsend-on-Tyne, is a new form of piston pump, the internal parts of which can be instantly withdrawn for inspection by a quarter turn of a breech lock. In Fig. 52 views of a small hand-operated pump ready for service and with the valves and barrel dismantled, are shown. It will be seen that the breech joint is a modified form of hose claw coupling which operates with a wedge tightening action. The details of the pump are indicated in the drawing Fig. 54. The pump casing may be mounted on a bed-plate in the manner shown. The casting which forms the body of the pump is furnished with suction and delivery flanges, and it is bored out conically to receive the breech block which carries the valves and the pump barrel. This consists of a brass casting with a copper tube brazed on to it, which forms the barrel in which the piston moves. A section through the piston showing the simple means adopted for gripping the piston packing is shown to the right of Fig. 54. For gritty liquids a leather or hemp packing is used, but for other substances such as foods, syrup and other liquors, an all-metal piston is employed. The valves are grouped in two pairs, one suction and one delivery valve being provided for each end of the pump. The pump is double-acting, and communication with the valve chamber is furnished by a passage on one side of the pump body from the front end of the cylinder, while a simple aperture in the valve casing wall connects this chamber with the space at the back end of the cylinder. The valves are of spherical form with narrow mitred seats to prevent jamming. As may be noted from Fig. 54, the stuffing-box for the piston-rod consists of a conical brass thimble which is put in from the inside of the cylinder and drawn up by an external nut. The construction is such that all parts can be taken asunder in a very short time without the aid of any special tools, and all parts subject to wear are easily renewable. In frosty weather the pump can be completely drained by simply opening the breech. The pumps shown in Figs. 52 and 54 is furnished with a hand-lever, and in the case of the latter design the fulcrum end of the hand lever is fitted with side bosses which slide in grooves formed in the pump bed-plate. For larger duties a simple form of geared crank drive—shown in Fig. 53—is employed. The whole of the gearing is enclosed in a cast iron trough, and is self lubricating, requiring practically no attention whatsoever. The firm is supplying four sizes of pumps with inlet and outlet pipe, diameters of 1in., 1¼in., 1½in. and 2in. respectively, and designed outputs of 690, 860, 1000 and 1560 gallons respectively. The first three are hand pumps, but for the fourth and largest pumps the crank gear-box drive, already referred to, is recommended. In addition to the pumps we have mentioned, there is a comprehensive display of ships' sidelights and windows, apparatus for fire-extinguishing systems, deck-washing and ships' heating, besides mountings for boilers, and valves and fittings for steam, water, oil, pneumatic and hydraulic installations.

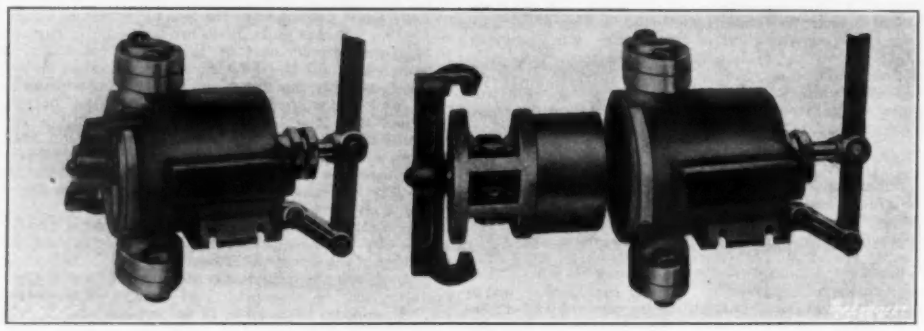


FIG. 52—HAND-OPERATED PISTON PUMP—SWINBURNE

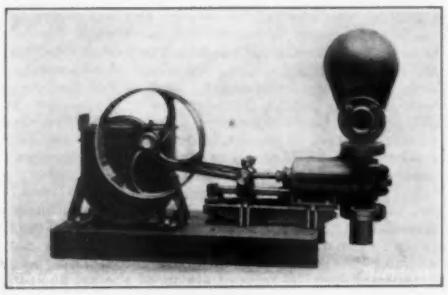


FIG. 53—BELT-DRIVEN PUMP—SWINBURNE

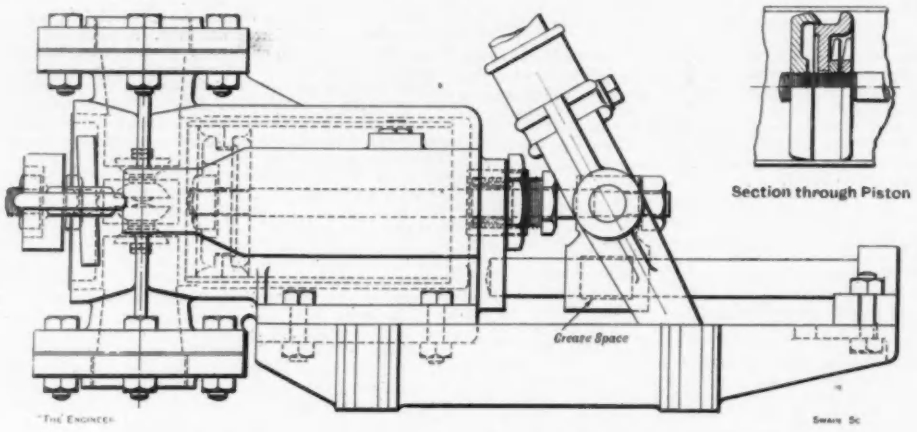


FIG. 54—ARRANGEMENT OF "BREECH" TYPE PISTON PUMP—SWINBURNE

J. H. HOLMES AND CO., LTD.

Among the larger exhibits on the stand of J. H. Holmes and Co., Ltd., of Newcastle-upon-Tyne, there is an electro-plating motor generator, a view of which we show in Fig. 55. The set consists of an alternating-current squirrel-cage motor coupled directly to a direct-current electro-plating generator with a separate exciter. The whole set is mounted on a combination bed-plate, and there are two bearings arranged between the motor and generator and the generator and exciter respectively. The designed output of the dynamo is 550 ampères at any required voltage between 2 and 10 volts. An enamelled slate switchboard, complete with all necessary instruments and switches, for use with the electro-plating set is also on view.

Another exhibit is a demonstration welding set, comprising an alternating-current squirrel-cage motor coupled directly to a direct-current welding dynamo with a separate exciter, the whole equipment being mounted on channel-irons, which form a baseplate. A view of this set is given in Fig. 56. The designed output of the dynamo is 25 to 200 ampères at 18 to 30 volts. On the front of the set is the switchboard, complete with an ammeter, a voltmeter, a shunt regulator, a series regulator, and a change-over switch, for the complete operation of the welding set. The welding equipment is in actual operation, so that demonstrations of electric-welding can be given.

Illustration Fig. 57 shows an alternating-current totally enclosed motor external-fan-ventilated type, which is exhibited and is shown belted to the first dynamo of the "Gramme" type, made by J. H. Holmes and Co., Ltd., in the year 1885. This dynamo was, until quite recently, running in actual service, and it was only at the special request of the makers that it was returned to them for retention on account of its historical interest. A new dynamo was supplied in place of it, but the old No. 1 dynamo was still quite capable of giving its original full rated output of 50 ampères at 60 volts, and its running capabilities are demonstrated on the stand.

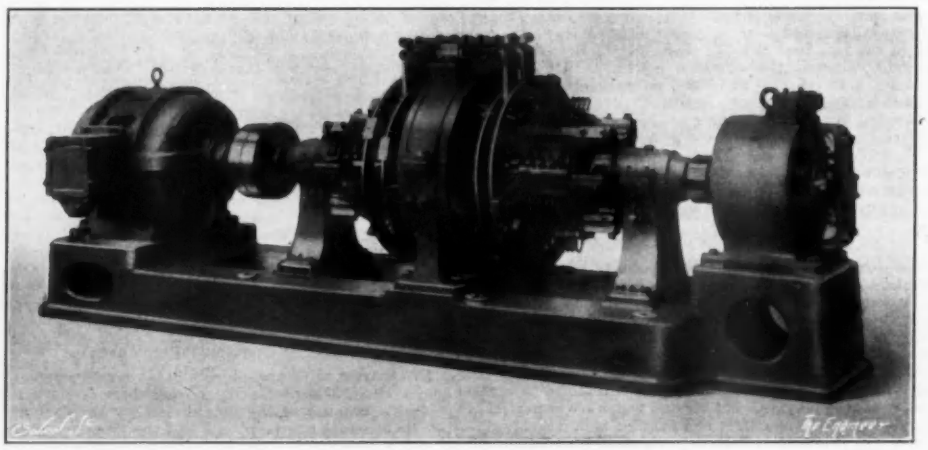


FIG. 55—MOTOR-GENERATOR SET FOR ELECTRO-PLATING—HOLMES

The firm is also showing a direct-current motor of the ventilated-enclosed type, with an output of 10 B.H.P., at 900 r.p.m.; besides this a bank of unbreakable grid resistances is shown along with some domestic appliances.

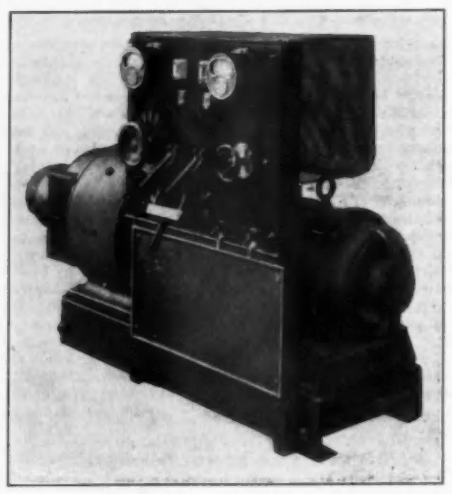


FIG. 56—WELDING SET—HOLMES

Another interesting exhibit is the "Castle" automatic electric street traffic control equipment, illustrated in Figs. 58 to 60, which is in successful

* No. V. appeared June 14th.

operation in Newcastle-upon-Tyne, and is now being demonstrated in other towns. This apparatus is one of the most recent products of the firm, and is certainly an interesting contribution towards the solution of traffic problems. As our illustration shows, the traffic signals are given by coloured lights arranged with automatic electric controls on a pillar fitting, the lamps being so designed that the signal is clearly visible by day and at night. If the case of a cross road be taken, then the installation consists of four sets of signal lamps so placed that one of them faces each part of the street to be controlled. There are, as shown in Fig. 58, three lamps in each box, one of which is coloured red, another amber, and the third

FIG. 57—FAN VENTILATED MOTOR—HOLMES

green. The controls are so contrived that only one lamp in a given box can be illuminated at one time, and that when the lights controlling one way are set at green, then those for the other way are at red. When approaching the road crossing, the driver of a vehicle looks to see whether the signal lamp facing him is set at red or green. If at green, he proceeds, knowing that the traffic at right angles to him is held up by the red light. After a definite time the signal changes from green to amber and then to red. The amber signal is a caution signal to enable the traffic proceeding in one direction to clear the crossing before the other traffic at right angles proceeds. The top light is a red one and the word "Stop" is moulded on the lens of the lamp; the middle light is the amber one, indicating "Caution;" while the bottom light is green and is marked "Go." These words are moulded in the lenses and are visible for some distance from them, but the colour of the lights is mainly relied upon for signalling purposes. The upper part of the lens is shaded by a cowl, which intensifies the illumination and enables the signals to be clearly seen even in bright sunlight. At the side of the lamp box there are small apertures, which show to pedestrians which signal is given. Experience with the system has definitely shown, we understand, that traffic can be speeded up by its use and that the roads are made more safe, both for motorists and pedestrians. The complete control mechanism is housed in a single box shown below the lamp box in Fig. 58. Other views of this box, showing the timing mechanism, are given in Figs. 59 and 60 respectively. By means of a double-pole switch and fuse mounted in the box it is possible to isolate each circuit for testing.

As shown in Fig. 60, the mechanism for timing the duration of the signals consists of a constant-speed motor operating a series of cams which in turn close contactor switches at definite intervals, which close or open the lamp circuits. The switches are so arranged that it is possible to change over from one signal to another practically instantaneously, and they are robustly designed so that when necessary as many as six four-way crossings can be operated by the same set of switches. In Fig. 59 we show the arrangement adopted for permitting the duration of signals to be altered, if so desired, by the authorised person in control of the traffic junction. At the lower part of the opening there will be seen a small dial with two short levers. By moving these levers over the dial the settings of the red and green lights can be varied over a range of five seconds to one minute and a-half in increments of five. For normal operation the amber coloured signal is set for two seconds' duration, but it can be adjusted for any setting up to six seconds, if desired. The door giving access to the adjusting dial also enables the main switch to be operated, but the parts are so arranged that no live parts are exposed. The main door of the box—see Fig. 60—when open, gives full access to the timing mechanism and the contactors. Another useful provision is the arrangement whereby the red and green lights can be switched off after midnight and the amber lights only caused to flash alone intermittently as a warning signal. If desired, a hand controller can also be fitted, which will cut out the automatic control and enable all the lights at a given crossing to be hand operated. The control mechanism is so designed that it can be operated either by direct or alternating current without readjustment of the timing arrangements.

SWAN, HUNTER, WIGHAM RICHARDSON AND CO., LTD.

The products of the shipyards and engine works of Swan, Hunter and Wigham Richardson and Co., Ltd., and the associated company of the Wallsend Slipway and Engineering Company, Ltd., are represented by a fine series of ship models. Prominent among these is a large scale model of the Cunard liner "Mauretania," which, although delivered to the owners twenty-two years ago, still holds the speed record for the North Atlantic Service. Among her notable performances is an average of 26 knots across the Atlantic, while a record trip was from Southampton to New York and back to Plymouth in the short time of twelve days and fifteen hours, a voyage which was completed by crossing the Channel to Cherbourg at a speed of 27·13 knots. The ship has averaged a speed of 25½ knots for no less than twenty-seven consecutive voyages, made under all kinds of weather conditions and in all seasons, totalling a distance of 77,500 n. miles. Other ships include models of the "Drottning Victoria," a train ferry ship for the Swedish Railway service between Trelleborg and Sassnitz on the Island of Rugen, in Germany. A triple-screw cable steamer the "Monarch," for H.M. Postmaster-General, and the "Kosma Minin," an icebreaker constructed for the Russian Government. Tanker construction is represented by a model of the "Sydhav, a motor tanker of 11,000 tons deadweight carrying capacity, propelled by Wallsend-Sulzer oil engines. Naval work is represented by models of H.M.S. "Comus" and the destroyer H.M.S "Laertes," while a large painting of the Singapore Floating Dry Dock, which was designed to lift 55,000 tons, is also displayed. The brass works department of the firm is represented by examples of sliding and ventilating windows, sanitary storm valves and special boiler water gauges, with gun-metal asbestos packed fittings.

DAVIDSON AND CO., LTD.

A comprehensive display of ventilating fans and dust-collecting apparatus is to be seen on the stand of Davidson and Co., Ltd., of the Sirocco Engineering Works, Belfast. The removal of dust is a problem to be faced in most industries, and for this reason special interest is attached to the dust fans shown by the

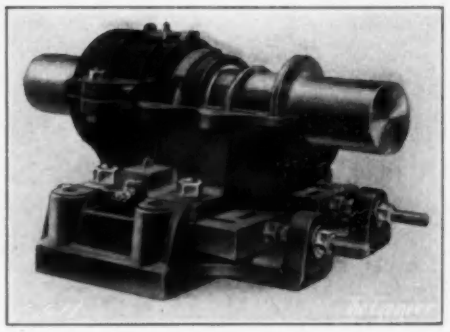


FIG. 61—MINE FAN BEARING—DAVIDSON

firm. These fans are furnished with spoon-shaped blades, which enable them not only to deal with fine dust but also, it is claimed, with fibrous or stringy material without any danger of choking. A special narrow width dust fan is shown, which is employed for extensive systems of duct work in which frictional resistances up to 12in. water gauge pressure have to be overcome.

A working model of the Davidson "Sirocco" dust-collector is exhibited. It is so arranged, on the suction side of the fan, that the dust does not pass through the fan. When desired, however, the collector can equally well be placed on the discharge side of the fan, in which position it will work with good efficiency. Several samples of light dust, which is specially difficult to separate from the air current, are available for examination. The firm's flue dust collector is also shown in the form of a model exhibiting the shunt pressure arrangement. A large range of high-pressure fans of the belt and motor-driven types are to be seen. These include blast fans for forge fires, a cupola fan designed to work at a pressure of 30in. water gauge, and a narrow width fan specially designed for delivering small quantities of air at high pressure.

In Fig. 61 we illustrate one of the firm's special mine fan bearings, built for a shaft diameter of 5in., and provided with an adjustable sole plate. The particular design of bearing adopted allows the alignment of the fan shaft to be readjusted in case of a subsidence taking place in the foundations. The lower-bearing bush can also be conveniently removed. It will be seen that provision is made to prevent dust from entering the bearing, and that a large oil reservoir

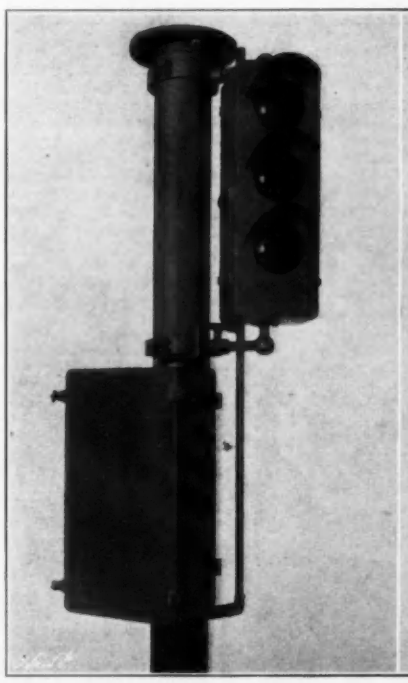


FIG. 58—TRAFFIC CONTROL SIGNAL

FIG. 59—SIGNAL ADJUSTING ARRANGEMENT

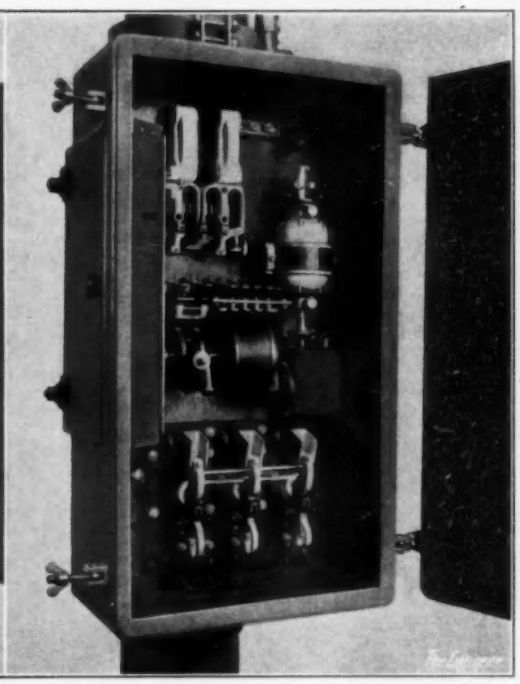


FIG. 60—INTERIOR OF CONTROL BOX—HOLMES

is provided, which, with ring lubricator, enables the bearing to be run over long periods without attention. As an example of recent mine fan practice, Messrs. Davidson are showing one of the blades from a 154in. double-inlet pan supplied to the Durban Navigation Colliery Company, Ltd., of South Africa. This fan has a designed output of 700,000 cubic feet of air per minute delivered against a pressure of 7in. water gauge.

(To be continued.)

Second World Power Conference.

UNDER the auspices of the International Executive Council of the World Power Conference, the German National Committee is organising the Second World Power Conference (Plenary Conference), to be held at Berlin in 1930. With the agreement of the International Executive Council, the following Technical Programme of this Conference, with notes and directions, is being submitted to the National Committees and representatives.

CLASS A. SOURCES OF POWER.

The papers of this class should not be detailed reports, but short accounts only, to be worked into collective surveys by the office of the Second World Power Conference. Particulars as to important publications which are regarded as authoritative for their respective countries by the National Committees, as well as all statistics which might serve as a basis for surveys on a large scale, will be gratefully accepted. The reports should be made with reference to the following points :—

Division I.—SOLID FUELS.
Division II.—LIQUID FUELS.
Division III.—GASEOUS FUELS.
Division IV.—WATER POWER.
Division V.—UTILISATION OF SOLAR ENERGY AND OF THE HEAT STORED IN THE EARTH; WIND POWER.

The following information is chiefly desired :—

Data and statistics on recent development of new sources of power. Data on prospective schemes of development of new sources of power. Important technical progress in the production (including production by synthetic processes) and the transport of solid, liquid, and gaseous fuel and data on important reports published previously.

CLASS B. POWER PRODUCTION; POWER TRANSMISSION; STORAGE.

Division I.

STEAM POWER PLANTS AND FUELS.

Section 1. Transport and storage of solid fuels.
Section 2. Handling and storage of pulverised coal.
Section 3. Handling and storage of liquid fuels.
Section 4. Transmission and storage of gaseous fuels (long distance gas supply).
Section 5. Heating plants for solid, pulverised, liquid, and gaseous fuels.
Section 6. Control of boiler plants.
Section 7. High-pressure steam generation (over 30 at).
Section 8. Steam engines and steam turbines.
Section 9. Mercury vapour turbines and binary-vapour turbines.
Section 10. Long-distance heating plants (steam, water).
Section 11. Heat accumulators (steam, water).
Section 12. Heat insulation.
Section 13. Connection between water power plants and steam power plants.

Division II.

INTERNAL COMBUSTION ENGINE PLANTS.

Section 1. Gas engines and gas turbines. Blast-furnace gas engines. Diesel engines. Supercharging. Utilisation of waste heat. Raising the speed of revolution. Pulverised coal engines. Neutralisation of exhaust gases.
Section 2. The Diesel engine for the peak loads of electric power stations.
Section 3. The internal combustion engine for transport.

Division III.

WATER POWER PLANTS.

Section 1. Survey of laws regulating the utilisation of water power.
Section 2. Design, construction, and operation of large dams and barrages. Hydraulic accumulators with natural admission.
Section 3. Water power in co-operation with irrigation and transport.
Section 4. Experimental research concerning the utilisation of water power.
Section 5. Development of water tubine design. High-pressure pipe lines. Hydraulic accumulators.

Division IV.

ELECTRIC POWER PLANTS.

Section 1. Generation and transformation of electric current; co-operation between power plants of various types.
Section 2. High-voltage transmission line (overhead lines and cables; safety devices).
Section 3. Automatic and semi-automatic power stations and sub-stations.
Section 4.—The use of auxiliary currents (Schwachstrom) in the operation of power plants.
Section 5. Storage of electricity.
Section 6. Wireless electric power transmission.

Division V.

MECHANICAL TRANSMISSION OF POWER, WITH SPECIAL REFERENCE TO GEARING.

CLASS C. UTILISATION OF POWER.

Mechanical, electrical, and heat energy in all forms are nowadays employed in all branches of human activity. It is therefore not intended to deal with well-known methods of power utilisation, and it would be of great value to learn from the different countries on which field, either of novel or increased power utilisation, they are mainly concentrating their attention. The following questions are suggested as being of special interest :—

Division I.

AGRICULTURE.

Section 1. Production of manures by means of power and gas on a large scale.
Section 2. Irrigation and drainage of large areas.
Section 3. Power utilisation in farming.

Division II.

DOMESTIC ECONOMY AND INDUSTRY.

Section 1. Increased utilisation of electricity in industry and in the household (power for small machines, such as vacuum cleaners, washing machines, irons, refrigerators, &c.); further utilisation of electrical power for cooking and heating (electric boilers).
Section 2. Increased utilisation of gas in the household, in industry and manufacture.

Division III.

TRANSPORT.

Section 1. Progress in electrification of railways; operation of branch lines.
Section 2. Improvements in heat utilisation in locomotives (steam turbine locomotive, Diesel locomotive, high-pressure steam locomotive, pulverised coal locomotive).
Section 3. Motor lorries for conveying goods to the railways or as substitutes for the latter.
Section 4. Power utilisation in navigation.

Division IV.

POWER UTILISATION IN MINES AND IN METALLURGICAL WORKS.

E.g., direct production of iron and other metals from ores by means of electrical energy.

Division V.

POWER UTILISATION IN BUILDING WORK AND IN FACTORIES.

CLASS D. GENERAL.

Division I.

DISTRIBUTION OF POWER.

Section 1. Progress in levelling the peak loads. Co-operation of private power stations to relieve long-distance power transmission systems.
Section 2. Stabilisation of the power market. Intensified and improved propaganda. Financing of power production and utilisation.

Division II.

POWER AND LEGISLATION.

Section 1. Interchange and sale of power. Wayleaves for power transmission lines of every kind. Transmission lines crossing various territories.
Section 2. Power and land development.
Section 3. Laws regulating the supply of electricity in large areas.
Section 4. Public and private power supply.

Division III.

TECHNICAL EDUCATION PROBLEMS.

Section 1. Technical education in connection with the construction and operation of power and distribution plants.
Section 2. Problems of technical education in connection with power economy.

Division IV.

CO-OPERATION.

Section 1. Power statistics and methods of compilation, with special reference to economics.
Section 2. The present state of standardisation in connection with engineering. Rules for power plant testing.
Section 3. Standardisation of nomenclature.

DIRECTIONS.

1. Independently of the classes and divisions of the Technical Programme of the Second Plenary World Power Conference, three or four papers will be read by outstanding international technical and industrial representatives before all members of the Conference. In these papers, which will be given with the approval of the International Executive Council, the whole field of power generation and utilisation will be reviewed.

2. The papers to be presented to the Conference should only be submitted by the respective National Committees or National Representatives. In countries where this recommendation cannot be carried out, contributions from individual authors will be accepted by special arrangement with the International Executive Council.

3. Papers shall not exceed about 7500 words in length. They shall be written either in German, English, or French, and shall be accompanied by a summary, not exceeding 500 words in length, in either of the two languages other than that in which the paper has been prepared. The strict scientific and objective character of the contributions must be maintained by all possible means.

4. In order that a proper index may be made, it is recommended that authors should attach to their papers a separate table of contents. This table should give a list, not only of the main divisions or headings of the paper, but also of subjects of importance referred to in the paper. Besides this index, the authors are requested to provide an index of headings under which they desire General Reporters to mention their paper in the General Reports.

5. With the exception of the mathematical symbols and formulæ, which should be written by hand, the text of the papers should be typewritten with double spacing, using one side of the page only. Two copies of each paper should be sent to the secretary of the Second Plenary World Power Conference not later than November 1st, 1929.

6. References and footnotes intended for printing in the text of the paper should be inserted in the typewritten copies on the same page as the matter to which they refer.

7. The maximum size of reproductions, photographs, drawings, &c., should be 100 mm. by 180 mm. Inscriptions should be either typewritten or pasted on the back of each photograph or drawing. The number of illustrations should be reduced as far as possible, and the German National Committee reserves the right to ask for payment for any illustrations above a reasonable maximum.

8. Photographs should be clear glossy prints and should be suitable for reproduction without retouching.

9. Drawings should be made with jet black ink on white paper. Letters and descriptions should be drawn in pencil, so as to enable the General Reporters of the Conference to insert a uniform lettering. As line drawings are improved by reduction, they should be prepared at about twice the linear size of the drawing as it will be printed (not more than 200 mm. by 360 mm.). Lines should be drawn clearly and sharply and be proportionately heavy to allow of reduction. Unless prepared by a draughtsman, all letters, shading, &c., should be drawn lightly with soft lead pencil serving as a guide to the engraver. If sectional or squared paper be used, only that with faint blue ink lines should be used. Red, black, or other coloured rulings should be avoided.

10. The symbols used in papers should, as far as possible, be those recognised internationally. Each author is particularly requested to state clearly the units named in his paper—*e.g.*, the English big or small ton (2000 lb. or 2240 lb.) and gallon of 8·33 lb. or 10 lb. volume of water, &c.

11. Authors will not receive any proof copies of their papers before the publication of advance copies for the Conference. They will, however, be given an opportunity until July 15th, 1930, of making minor corrections in their papers which will be then embodied in the "Transactions" of the Second Plenary World Power Conference.

12. Official delegates to the Second Plenary World Power Conference—not to exceed ten in number from any one country—will be entitled to receive free of cost one copy of each paper in which they are interested. Other members will be asked to pay for such papers as they require—announcements regarding the price of the papers will be made later.

13. The Committee of the Second Plenary World Power Conference will appoint General Reporters for each Section of the Programme. These General Reporters will prepare extracts of papers presented to the Conference, and will put to discussion such subjects as they deem to be of general interest.

14. All correspondence should be addressed to Weltkraft, Berlin, N.W. 7, Ingenieurhaus (telegrams, "Weltkraft, Berlin").

The Technical Sub-committees have prepared a number of leaflets containing suggestions for the preparation of papers. These suggestion sheets can be obtained by prospective authors from the secretaries of their respective National Committees.

CORROSION AND RATE OF WATER FLOW.

THE importance of velocity of water flow as affecting corrosion of tubes was clearly demonstrated by an experiment shown at the Conversazione of the Institution of Civil Engineers last week. The experiment was conducted by Major J. N. Dundas Heenan, in order to illustrate the difference between the corrosive effects of water in turbulent and in stream-line flow. A continuous and smooth jet of water was projected through a nozzle of about ¼in. in diameter on to a circular steel plate placed horizontally about 1in. below the nozzle. The plate was about 10in. in diameter, and the surface had been ground flat, polished and cleaned with ether to remove any trace of grease. The water, discharged at a constant velocity, spread from the centre all over the surface of the plate, each particle as it travelled away from the centre naturally decreasing in velocity.

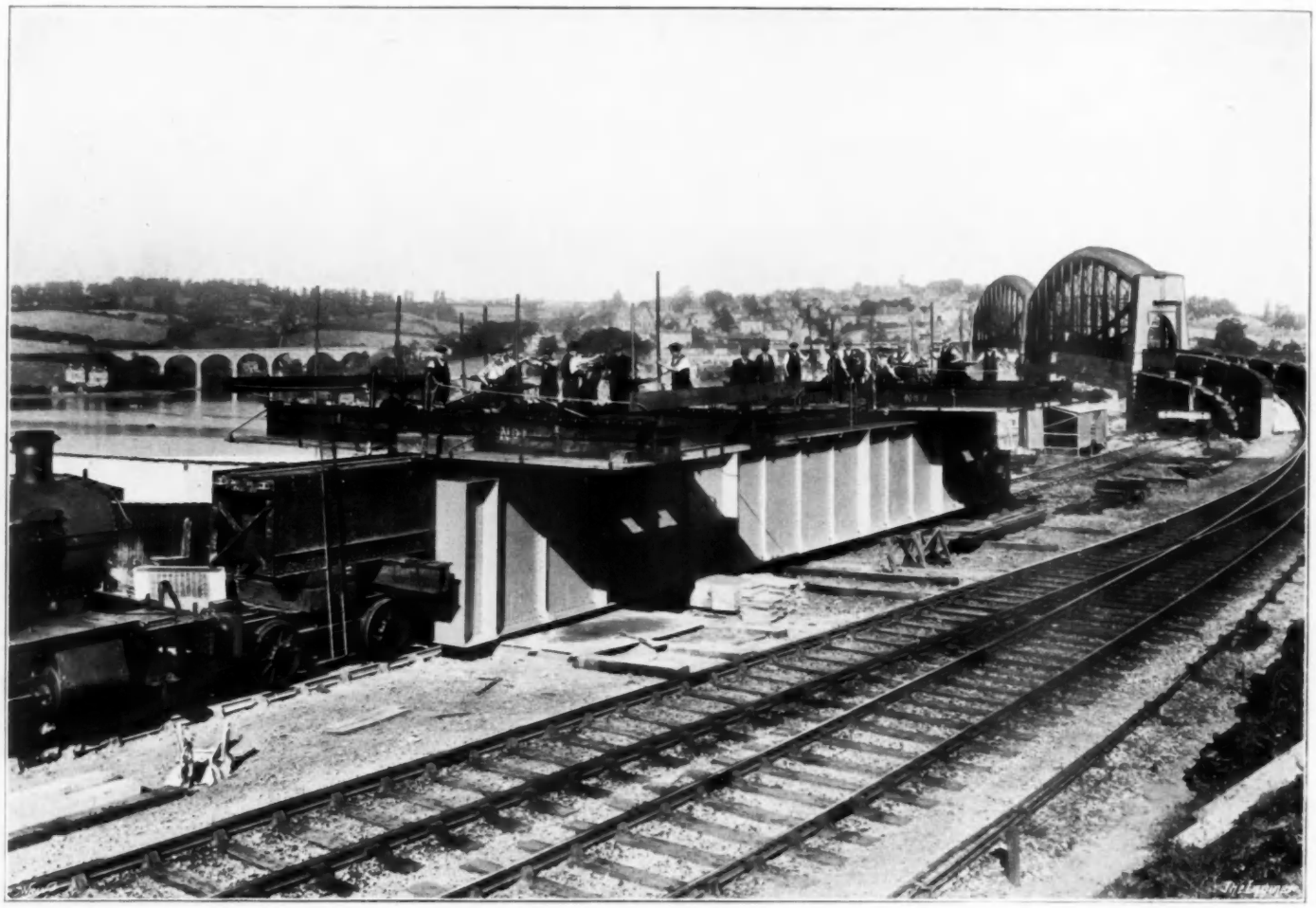
It was found that at a point determined by the rate of flow a circular wave was formed on the plate concentric with the nozzle, and that as the velocity of the water was altered by opening or closing a stop valve from the down pipe, the diameter of the circular wave increased or decreased. This wave indicated the transition from turbulent flow to stream-line flow. The valve on the down pipe having been set so that the diameter of the wave was about 4in., a constant flow was maintained for some time. It was soon noticed that where the water was in stream-line flow, on the plate outside the wave diameter small bubbles formed and remained, whereas on the surface of the plate inside the diameter of the wave, where the water was in turbulent flow, no bubbles adhered to the plate's surface.

After the lapse of a few hours the outer diameter of the plate started to corrode, while the inner diameter showed no traces of corrosion. The explanation of this phenomenon is that where the water is in turbulent flow the small bubbles of oxygen are swept away and therefore cannot act on the metal. When the velocity of the water has fallen below that required for turbulent flow and stream-line flow occurs, the bubbles are not swept away, but cling to the plate surface, which they corrode.

The same experiment was made in order to determine the most suitable velocity of water flow to avoid internal corrosion in the steel tubes of the Foster economiser. It clearly demonstrated that the flow of water through the tubes of an economiser should be above the critical velocity so as to give turbulent flow, and permit the scrubbing action of the water to prevent the small bubbles of oxygen from adhering to the internal surface of the tubes and damaging them.

THE recently formed Boeing Aircraft, Ltd., of Vancouver, Canada, has given an order for the construction of the first unit of its aeroplanes factory there to the Austin Company of Canada, which firm prepared the plans. The building will be of the latest industrial type, with walls largely of glass encased in steel. Construction is also to be started immediately on the production of "Bie" flying boats at the yard of the Hoffar-Beeching Shipyards, Ltd.

SALTASH BRIDGE, G.W.R.—RECONS



ERECTION WAGON IN SIDING "DRESSED" WITH NEW GIRDERS

ERECTION WAGON IN OPERATION ON SPAN NO. 4 ON DEVON SIDE

UNIV. OF MICH.

END VIEW OF ERECTION WAGON OLD GIRDERS SLEWED OUT

ERECTION WAGON WITHDRAWING OLD GIRDERS AFTER RECONSTRUCTION OF A SPAN

UNIV. OF MICH.

South African Engineering Notes.

The Benguela Railway.

THE official opening of the Benguela Railway took place on Monday, June 10th. Sir Robert Williams, who had so much to do with the founding of the Tanganyika Concessions, which is largely interested in the rich copper mines of the Katanga, has made the construction of the Lobito Bay, or Benguela, railway his life-work. The railway was built under agreement with the Katanga railways, whereby the earnings of the three railway systems tapping the Congo are to be pooled in order mutually to help each other. The three lines in question are :—(1) The Katanga railway, which links up the Rhodesian railways with the navigable Congo at Bukoma ; (2) the line connecting that railway with the Benguela railway ; (3) the line connecting the Lower Congo railway with the Katanga railway at Bukoma. British, Belgian and Portuguese companies co-operated to complete the Benguela line and to facilitate the industrial development of the Congo and Angola. The Benguela railway created trade as it advanced, and over a portion of the line the traffic has more than doubled during the past four years. It has opened up a rich and fertile country, which has been described as the " Argentine of Africa."

The Benguela railway was begun with the object of providing an outlet to the Atlantic for the rich Central Africa regions of the Upper Congo basin, and Sir Robert Williams obtained a concession from the Portuguese to build it as far back as 1902. Difficulties of finance and engineering prevented very rapid progress being made with the line, which, up to the cessation of construction necessitated by the war, had advanced 342 miles inland. Since the war the 496 miles to the new Congo border has been completed, and by the end of next year the line which is being constructed from the Angola side should reach the main Katanga line.

From London to Cape Town and thence by rail to the Katanga copper belt occupies on a fair average twenty-six days. Assuming equally fast vessels, the time from London to Kambooe, *viâ* Lobito Bay, should not exceed eighteen days, a saving of eight days as compared with the present route. The Benguela route should therefore attract the passenger and a large proportion of the freight traffic between Europe and Katanga. The great advantage of Lobito Bay to the Belgian railways is that it will bring the copper traffic over about 600 miles of them, thereby greatly adding to their revenue and enabling them to give lower rates for internal traffic. This will assist the development of Angola, and when the products from that territory reach a considerable bulk, the position will react favourably on the transport costs of the Katanga copper. As soon as the Benguela railway is linked up with the Chemin de Fer du Katanga there will be a through trans-African route over 2800 miles long connecting Lobito Bay with Beira, and linking up the Portuguese territories of Angola and Mozambique. This is, in fact, likely to be the first all-rail transcontinental route to be completed in Africa. Apart from its future potentialities as a supply route for the Katanga mining region, the Benguela railway is already earning substantial sums from the local traffic that has sprung up in the plateau region traversed by the earlier completed portion of the line. From the mining zone its receipts should very rapidly expand.

Lobito Bay, the coast terminus of the Benguela railway, is the best harbour in South-West Africa, having deep water close to the shore, protected by an outlying sand spit. From Lobito Bay the railway runs southward along the coast to the much more ancient town of Benguela, which gives its name to the line. The town is 22½ miles from its more modern rival, and has a population of about 4000, but it does not possess the same advantages as a port, vessels of moderate draught being compelled to lie some miles off shore. Between Lobito and Benguela the railway crosses the Catumbella River by a notable viaduct, and passes the now deserted town of the same name. After leaving Benguela behind, the railway turns inland. Lengue Station at the lower end of the Lengue Gorge is 31½ miles from the starting point. In the next 3 miles the track mounts 459ft. to Sao Pedro by gradients which render a rack rail necessary. The altitude at Sao Pedro is 820ft. above sea level. For the next 90 miles the railway passes through an arid belt, which cuts off the coast from the fertile inland plateau until the building of the line provided a way across the barrier. At an altitude of 5600ft. and a distance of about 280 miles from the coast is situated Huambo, a healthy spot which, it is expected, will be made the capital of Angola in place of Loando, which is an unhealthy place on the coast.

Rhodesian Railways.

The total earnings of the Rhodesian Railway system for the financial year ended September 30th, 1928, amounted to £5,105,461, the first time in the history of the railways that revenue has exceeded the five millions mark. While the earnings exceeded those of the previous year by nearly £200,000, the gross operating expenditure rose by over £300,000—thus resulting in a decrease of £116,522 in the net operating revenue, which amounted to £2,089,859 for the year. The revenue items show that coal and coke traffic to the Congo was responsible for an increased revenue of £189,000, though against that had to be set a fall in the revenue derived from railway construction material for the Congo, amounting to £134,000, and from general goods for the Congo of £95,000. It has to be remembered that large reductions in rates and fares were granted from May of last year.

The quantity of asbestos consigned over the railway during the year amounted to 40,918 tons, constituting a record. Close upon 100,000 tons of copper were railed over the Rhodesian Railways during the last financial year, 93·5 per cent. of the total emanating from the Union Minière in the Congo, the balance being despatched from Bwana M'Kubwa in Northern Rhodesia. Messrs. Pauling and Co. have secured the contract for the construction of the Ukana branch lines, 40 miles in length, which will leave the main line just north of U'dola, and a few miles south of the Congo border, and so connect up the copper mine now being developed at N'Kana. The branch line from near N'dola to the Roan Antelope mine, a distance of about 22 miles, was opened on January 22nd. No official announcement has yet been made concerning the construction of the Umboe and Umoukwes branch lines in Southern Rhodesia. It is believed, however, that the subject of both branch lines is engaging the active attention of the Southern Rhodesia Government and the railway authorities. A contract has been placed with the Cleveland Bridge and Engineering Company, of Darlington, for the reconstruction of the Victoria Falls Bridge. The work, which is due to commence shortly, is not, however, an actual reconstruction of the bridge, but consists of the strengthening and modification of the deck. At the present time there are two railway tracks over the bridge —only one of which is in use—and a footpath on either side. When the new scheme is completed, one of these tracks will have been dispensed with and the remaining one will have been moved practically to the centre of the bridge. The alterations to be made will provide for a motor road 15ft. 6in. wide on the upstream side and a footway 9ft. wide on the downstream side. The road motor services of the Rhodesian Railways continue to increase, the response of the farmers to the transport facilities being most gratifying. The fleet of vehicles at present in service comprises twenty-two six-wheeled and two four-wheeled lorries, together with five trailers. Orders have been placed for five additional 5-ton trailers and five 2-ton trailers, and also five additional Thornycroft 5-ton lorries.

A Simple Print Developing Machine.

A MACHINE for developing photo-prints by the dye process—that is to say, those in which a positive print is produced directly from the tracing—which represents an advance on the machine described and illustrated in our issue of September 7th, 1928, has recently been brought out by B. J. Hall and Co., Ltd., of Chalfont House, Westminster. The arrangement of the new machine is more

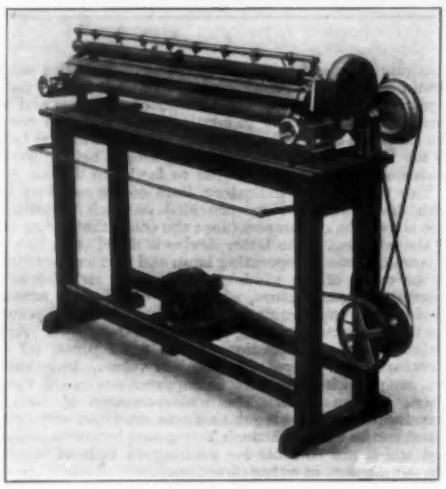
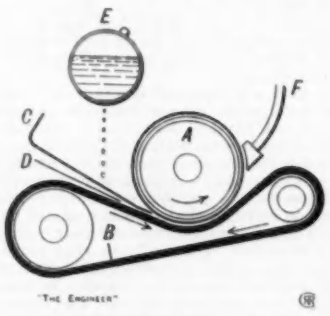


PHOTO-PRINT DEVELOPING MACHINE

simple than that of its prototype, and it is more compact, but it is equally effective.

The broad principle of the machine remains the same, the exposed print being dragged between a rubber band and a felt-covered roll, which rubs the developing solution on to one face of the paper. In the original machine, it will be remembered, there were as many as five rollers in all. In the new design, as will be seen from the diagram, the number has been reduced to three.

The developing roll is shown at A and the rubber band at B. The two are geared together, but the roll runs at a slightly higher peripheral speed than the band, so that it has a rubbing action on the print. The print D is fed into the machine between the band and the " interceptor " plate C. This plate is held in contact with the



ARRANGEMENT OF ROLLERS

band and slightly retards the motion of the paper, so that the roll may distribute the developer evenly over the surface. The paper goes straight through the machine, being delivered at the back and prevented from following round the rolls by the fingers F. These fingers have loose pivoted ends, which are ground to a fine edge and gently rest on the roll. One passage through the machine is sufficient to develop a print, and it is delivered sufficiently dry to be used almost immediately without further drying.

A rather ingenious system is employed for distributing the developer over the roll. Above the roll there is a tubular reservoir for the developing liquid, which has a row of perforations in the bottom. The holes are so small that the liquid will not run out unless air is admitted to the upper part of the reservoir. For this purpose a small valve is provided, and the rate of flow of the developer can be adjusted to a nicety. The reservoir is mounted on trunnions and can be rocked so that the holes are either at the bottom or above the liquid level. This rotation is effected by a band running over a grooved pulley in one of the trunnions and the amount of the rotation is determined by a fixed stop. In the connection of the driving pulley there is a dog clutch, with single dogs, which provides sufficient back-lash to allow for the angular movement of the reservoir. When the machine is started the dog clutch opens, against the resistance of a spring, and during this movement the belt turns the reservoir to the feeding position, where it is checked by a stop. The belt then slips on its pulley until the machine is stopped, when the spring closes up the jaws of the clutch again, and the reservoir is returned to the non-feeding position. By these means, it will be seen, the supply of developer is properly regulated, and the blanket on the roll becomes neither too wet nor too dry.

The machine may be driven by a small electric motor, as shown in the half-tone engraving, or by means of a crank handle. It will deliver prints at a lineal speed of from 2ft. to 6ft. per minute.

SIXTY YEARS AGO.

SINCE Whitworth founded his scholarship scheme sixty years ago, the conditions governing the awards have undergone considerable change. In our issue of June 18th, 1869, we set forth the rules which the Lords of the Committee of Privy Council on Education had, in concert with Mr. Whitworth, made for awarding the scholarships in that year. The theoretical side was covered by the examination of the Science and Art Department in mathematics, mechanics, geometry, machine construction and drawing, sound, light and heat, magnetism and electricity, inorganic chemistry and metallurgy. In addition, the competitors were to pass a special examination in smiths' work, turning, filing and fitting or pattern making and moulding. No candidate was to be eligible to obtain a scholarship who had not shown his power to use at least one of the following tools ; the axe, the saw and plane, the hammer and chisel, the file, the forge. Candidates who chose to show their practical ability with the axe would be required to square up a block of wood 1ft. long and 6in. in diameter, to make a spoke for a cartwheel, to shaft an axe, and to cut out wheel spokes ready for fitting into the nave. Those professing the saw and plane would be required to saw from a plank two pieces of timber 3ft. long and 3in. square, and to plane them up true, to make a box 18in. by 9in. by 9in. planed up true, and with dovetailed joints, and to saw out and plane up two parallel strips measuring 2ft. by 2in. by ¼in. Candidates selecting the file would be required to file two sides of a cast iron inch cube as flat as possible with a Stubbs' 12in. second cut file, the stroke of the file being not less than 9in., to file up a wrought iron ½in. or 1in. hexagonal nut, to file two parallel strips of iron or steel and to file up a pocket square as true as possible. Those candidates taking the forge would be required to weld together two pieces of ¼in. square iron, to make a pair of smith's tongs, to make the head of a hammer, to make a pick, to make 2ft. of ¼in. chain with hook and ring, to make a complete horseshoe, to cut off, draw out and harden a chipping chisel or a drill, to make a pair of small callipers, and to make a pocket square. Mr. Whitworth expressed the desire that the highest attainable marks for the practical work should be about equal to the highest obtainable for the examinations in the theoretical subjects.

B.E.S.A. SPECIFICATIONS.

KEYS AND KEYWAYS, SPLINES AND SERRATIONS.

An enlarged and comprehensive British Standard Specification, covering all types of keys, has now been published in two parts by the British Engineering Standards Association—B.S.S. No. 46, Parts 1 and 2, 1929. The standardisation of keys and keyways was first undertaken many years ago, and a British Standard Specification which incorporated a table of dimensions for rectangular parallel keys and key bars, was published in 1909. This specification was amplified in 1924 by the publication of an additional part, in which the dimensions for the rectangular parallel keys was modified, and an additional table was included for the dimensions of square parallel keys.

In the new issue a specification for steel key bars of four different qualities of steels is included in Part 1, which supersedes the 1909 and 1929 editions, and tables of dimensions are given for the following types of keys and keyways : —Rectangular and square parallel keys ; rectangular and square taper keys ; plain and big-head taper keys ; peg-feather keys ; woodruff keys ; tangential keys. A standard for the taper and method of keying for coned shaft ends is also included.

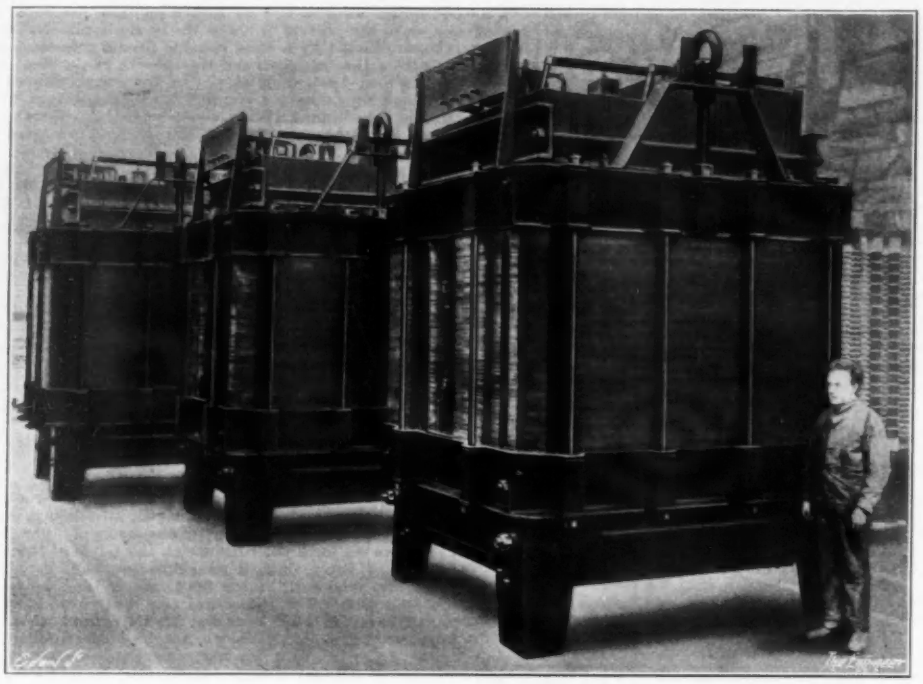
No. 46, Part 2, covers splines and serrations, and tables of dimensions have been drawn up for the following spline shafts and the corresponding holes :—Four and six splines, shallow and deep ; multiple splines ; serrations. The table of multiple splines has been prepared on the basis of eight splines per inch diameter, and is put forward as a tentative standard.

In both parts of the specification there is a fully illustrated nomenclature section, in which definitions are given for all the various types of keys. It is hoped that this section, which has been prepared in the closest collaboration with industry, will result in uniformity in the use of terms.

Copies of each part may be obtained, price 2s. 2d. each, post free, from the publications department, British Engineering Standards Association, 28, Victoria-street, London, S.W. 1.

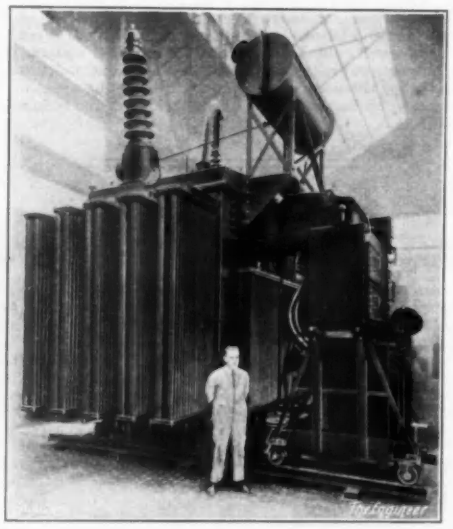
GROUP OF THREE 15,000 kVA, 132,000-VOLT TRANSFORMERS

THE METROPOLITAN-VICKERS ELECTRICAL COMPANY, LTD., LONDON, ENGINEERS



132,000-Volt Transformers and Switchgear for the Grid.

THE 132,000-volt equipment being supplied by the Metropolitan-Vickers Company for the Central Scotland section of the "grid" includes some high-capacity transformers, viz., two of 60,000 kVA capacity and three of 45,000 kVA capacity, arranged in each case in three single-phase units, together with two 15,000 kVA three-phase units, and the whole of the 132,000-volt switchgear for the seven main sub-stations of the western part of the section. The view below shows a 15,000 kVA single-phase transformer unit of one of the 45,000 kVA groups, while, above, is seen a group of three similar units removed from their tanks. The transformers, which are for step-up or step-down service, have a voltage ratio of 20/132 kV, and are arranged for delta-star connection. Large detachable radiators are fitted so that with natural cooling the transformers will give 60 per cent. of their full rating, *i.e.*, 27,000



15,000 kVA. 132 kV TRANSFORMER

kVA in the case of the 45,000 kVA group illustrated. The radiators are bolted to the tank at the top and bottom, and valves are provided for both connections, thus enabling the radiators to be detached for shipment without removing the oil from the tank body. Each transformer is also provided with an external air-blast oil-cooler, complete with fan and oil circulating pump. The cooling plant is brought into commission automatically by means of a temperature device on the transformer, when the temperature exceeds a predetermined value and is automatically shut down when the temperature falls below this value.

On-load voltage regulating gear is provided on each unit to give plus and minus 10 per cent. variation in steps of 1·43 per cent. The regulating gear, which is to be seen in the lower illustration is of the contactor type, operating on tappings situated near the high-voltage neutral point of the transformer, which is solidly and permanently earthed. A reactor having a mid-point running position is situated in a tank below the contactor gear, and is used to bridge the sections of the transformer winding while changing from one tapping to another. It is also used to obtain a mid-point running position between each pair of tappings, thus reducing the number of tappings and contactors required. The regulating gear and the reactor are mounted on a separate under carriage which is bolted to the transformer tank, adjusting screws being provided underneath the regulating gear to facilitate linking up.

Two temperature indicators, both of the capillary type with dial indicators, are provided on each transformer. One shows the oil temperature; the other the temperature of the winding. The latter device is fitted with two sets of contacts, one set operating lamp and klaxon horn alarms in the event of the winding temperature reaching a predetermined temperature, whilst the other set is arranged to close the trip circuit of the oil switch in the event of the temperature increasing a further 10 deg. Cent. Accessories, including inspection covers, relief pipes, oil conservators, filter valves, oil-sampling valves, drain valves, &c., are provided according to requirements on the various pieces of apparatus. The undercarriages of both the transformers and the regulating gear are fitted with rollers, which can be turned through 90 deg. and locked in position, and which are suitable for running on rails of standard 4ft. 8½in. gauge in either direction.

Diesel Engine Users Association.

ON Friday, June 14th, 1929, at the June meeting of the Diesel Engine Users Association, Mr. C. H. Faris read a paper on "Repairs to Diesel Engine Parts by Electro-deposition."

The author described a method of electro-chemical deposition which has been evolved and has been successfully used for building up worn or corroded hydraulic rams, compressor plungers, steam engine piston-rods, pump impeller shafts, and numerous automobile parts. While the cost of the deposition operation was less than that of replacement, additional satisfaction had been derived from the longer subsequent service obtained. It was pointed out, however that the process under discussion was not to be confused with that of ordinary plating, in which no real adhesion of the thin deposited layer occurred. In the deposition process referred to, very heavy deposits of nickel, and in certain cases of copper, chromium, cobalt, cadmium, and lead, could be obtained with perfect adhesion.

Dealing first with general engineering work, typical examples were given of various tests, including tests by the National Physical Laboratory, made on some of the results of the process, both in the laboratory and under actual service conditions. Among the examples given was that of a gear-box shaft 24in. in length, taken from a petrol engine vehicle engaged on heavy haulage. The splines at one end had sheared away almost completely. The splined end was ground true and then built up by the deposition of nickel. The shaft has since had four years of most exacting service, but shows little sign of wear and no sign of any loosening of the deposit. In another case, exemplifying the adhesion of the deposited metal, a gear ring was built up on the worn gear teeth and was in perfect condition after two years' service. In another instance the worn pistons and gudgeon pins of a Reavell air compressor were most successfully treated.

With regard to the question of wear, it was stated by Mr. Faris that the general idea that nickel is a soft metal was not borne out by the data obtained in actual service conditions. The melting point of nickel was given as 1452 deg. Cent., and an average hardness figure would be 320 Brinell, though in special circumstances as high a figure as 370 Brinell can be obtained. The metal responded very satisfactorily to the Herbert pendulum hardness tester. Examples were given showing reduced wear and increased resistance to corrosion after the process had been applied to worn parts.

Dealing with matters of more direct interest to the Diesel engine user, the author said that it was worthy of note that in four new motor ships now under construction, all the inlet and exhaust valves were being reduced 0·020in. below the standard diameter on the spindle portion, in order to allow for a nickel deposit of 0·010in. Such treatment of the parts as a part of the manufacturing process probably ensured that the fullest possible advantages were derived from the process of deposition.

Other parts on which electro-deposition can be successfully carried out included fuel oil needle valves, plungers for fuel valves, starting and air inlet valves, air compressor parts, pistons, gudgeons, crank shafts, pumps, cam shaft journals and cams and other details, and it mattered not if the surface was iron, steel, or bronze. Further, localised treatment could be applied if required. The author stated that it was not advisable to fit a piston with a nickel surface into a liner, the bore of which has been surfaced with the same metal. Recent extensions to the plant with which he was concerned had made it possible to handle individual jobs up to 6 tons and up to 17ft. by 6ft. diameter, and to grind or turn parts 22in. in diameter, with a length up to 26ft.

BRITISH ECONOMIC MISSION TO AUSTRALIA.

THE Federation of British Industries has placed on record its high appreciation of the valuable services rendered to inter-Imperial trade by the Economic Mission under the chairmanship of Sir Arthur Duckham, which, it will be remembered, recently visited Australia at the invitation of the Australian Government to study and report upon economic, financial and general conditions in the interests of the Commonwealth.

After studying the report of the Mission, and having had the advantage of being addressed by members of it, the Federation makes the following suggestions for practical action to carry out its recommendations:—

(1) The Federation would request the Economic Mission to convey to the proper quarters in Australia an expression of the hope that representatives of primary producers and industrialists from Australia will visit Great Britain in the near future, for the purpose of investigating the possibility of increasing the sale of Australian primary products in the United Kingdom, and the capacity of Great Britain to supply Australia with those manufactured goods which she is not in a position to manufacture herself.

In the event of such representatives visiting Great Britain, the F.B.I. will be happy to place its organisation, both in London and in the provinces, entirely at their disposal, for the purpose of facilitating their task.

(2) The Federation would further suggest that individual trades should consider the desirability of sending representatives to Australia, with the object of examining the question of what types of goods can, with economic advantage, be manufactured in Australia, and of exploring the possibility of British initiative and capital co-operating in this direction.

In the case of goods which Australia would not be capable of manufacturing economically, and would consequently have to import, these representatives, it is hoped, would be able to prove that Great Britain was fully capable of supplying Australia with these necessary imports, and that it was to the interest of both countries that on these goods a substantial and effective preference should be granted to British manufacturers.

The Federation offers its services in order to bring the interested industries into touch with members of the Economic Mission, in order that this question may be gone into by the individual trades, and expresses the hope that Sir Arthur Duckham and his colleagues will agree to meet the representatives of any industries which may desire to consider this line of action.

(3) Finally the Federation expresses the hope that no opportunity will be lost by his Majesty's Government of following up the valuable work performed by Sir Arthur Duckham's Mission, with special reference to the question of facilitating trade between the two countries and of endeavouring, in collaboration with the Australian authorities, to reconcile any divergence of interest.

LAUNCHES AND TRIAL TRIPS.

THOMAS HOLT, single-screw steamer; built by Cammell Laird and Co., Ltd., to the order of John Holt and Co. (Liverpool), Ltd.; dimensions, 329ft. 6in. by 46ft. 10in. by 27ft. 6in.; to carry cargo. Engines, triple-expansion, pressure 180 lb. per square inch; constructed by the builders; launch, June 6th.

LANGLEECRAG, steel screw steamer; built by Palmers Shipbuilding and Iron Company, Ltd., to the order of the Medomsley Steam Shipping Company, Ltd. Engines, triple-expansion; constructed by North-Eastern Marine Engineering Company, Ltd.; launch, June 7th.

600-TON FLOATING DOCK for Port Stanley, East Falkland Islands; built by Swan, Hunter and Wigham Richardson, Ltd., to the order of Falkland Islands Company, Ltd.; dimensions, 180ft. by 61ft. 3in. by 45ft.; date completed, June 7th, 1929.

IRWIN, twin-screw steamer; built by D. and W. Henderson and Co., Ltd., to the order of South Indian Railway Company; dimensions, 250ft. by 38ft. by 12ft.; to carry passengers and cargo. Engines, two-geared turbines and water-tube boilers; constructed by Yarrow and Co., Ltd.; launch, June 10th.

CAMPANA, mail and passenger steamer; built by Swan, Hunter and Wigham Richardson, Ltd., to the order of Société Generale de Transports Maritimes à Vapeur; dimensions, 527ft. by 67ft.; to carry 7000 tons deadweight. Engines, two sets single reduction geared turbines; launch, June 11th.

THE SHIPPING, ENGINEERING AND MACHINERY EXHIBITION, 1929.—On Wednesday last the Committee of Experts of the Shipping, Engineering and Machinery Exhibition met at luncheon, at the invitation of Mr. F. W. Bridges, the organiser. In the unavoidable absence of the Duke of Northumberland, President, Dr. Hele-Shaw took the chair. Several resolutions connected with the Exhibition were passed unanimously, and Mr. Bridges informed the members of the Committee that the prospects for the forthcoming Exhibition were brighter than for any of its predecessors. The fishing industry, coasting vessels, and passenger traffic will receive more attention than heretofore, and it is hoped to stage an interesting collection of drawings and models—a pageant of British shipping—in the galleries.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

Trade Situation.

THERE has been no appreciable variation during the past week in the conditions ruling in the heavy industries of the Midlands and Staffordshire. If anything, orders are coming through with more consistency, and, while business still remains patchy, many manufacturers report a fair flow of orders. There is some increase in the demand for raw materials, and that will have an effect upon other branches of manufacture in due course. General engineers in this district are a little better employed, and though constructional engineers are quiet, automobile engineers continue to have a good volume of orders on their books, while engineers producing machine tools are very busy. While this is chiefly due to calls from the motor trades, machine tool makers state that in many branches of industry manufacturers are becoming more alive to the possibilities of lowering production costs by the introduction of up-to-date equipment. Considering this is normally a dull season, Midland industries are keeping up very well.

Demand for Raw Iron.

Demand for pig iron has undoubtedly improved, for Midland blast-furnacemen can show substantial additions to their order books made during the past week or so. Not only so, but some of this new business is claimed to have been taken at prices in advance of the recognised market level. The output of some furnaces is said to be committed for four to five months ahead; hence some increase in production would not come as a surprise. Midland smelters have agreed to stand by the price-fixing agreement for a further twelve months, and unanimity in their ranks is only broken in one instance. The difficulty of maintaining prices under these circumstances is not considered to be great, especially now that there is something of a buying movement in progress. While many of the ironfoundries are short of work, there are considerable prospects of an increase in activity in the near future. Ironfounders have in some instances made certain of supplies for some time to come, but there are others, including some large concerns, who are content to buy in the open market such supplies of pig iron as become necessary from time to time. They hold that present prices are out of harmony with the realities of trade. Blast-furnacemen can afford at the moment, however, to smile at such protestations. Northamptonshire and Derbyshire forge and foundry irons are maintained at the agreed selling figure, and nothing will induce producers to dispose of material at lower rates. Hematite is selling well. For East Coast mixed numbers the price is now £4 10s. delivered Birmingham.

Staffordshire Iron.

In the marked bar department of the Staffordshire iron trade events progress smoothly. Values are steady at £12 per ton, and orders filter through in just sufficient numbers to keep the mills regularly employed. There is no great reserve of orders on ironmasters' books, but they are satisfied they will be able to carry on without undue worry. The efforts to keep up Crown bar prices are continued, and Staffordshire makers are making every effort to secure £10 per ton for their output. Consumers claim to be able to buy at at least half-a-crown below that figure. Nut and bolt and fencing bars are named £9 2s. 6d. and are slow of sale. New buying of Belgian iron for nut and bolt making is quiet, but considerable tonnages continue to come into this district on old contracts. Wrought iron tube strip has hardened again and many sellers now quote £11 per ton. Makers' order books are stated to be thinner than they were a while ago, and consumers are accordingly making efforts to get orders accepted at the old price of £10 17s. 6d. It would appear that they are meeting with some success.

Steel.

In the finished steel department there is no change of moment to record. Business continues fair to medium, with values unchanged. Constructional engineers and other users are hoping for better business in the immediate future, necessitating the use of considerable tonnages of steel. In the half-products department the strong position in which British makers find themselves is incidental to the higher range of prices they are endeavouring to obtain for their product. Continental selling prices are so high that native makers can afford to ignore this competition. Birmingham merchants are, they report, doing practically nothing with foreign steel semis. Many local steel works are now endeavouring to obtain a further advance of from half-a-crown to five shillings per ton on billets. It is still possible, however, to purchase English billets at £6 12s. 6d. and Welsh billets at £6 10s. The call for small rolled steel bars is maintained, as is the price asked for them. Black Country tube mills are busy, and measures are being taken to augment the productive capacity of a Midland steel works which produces raw material for them. Mill owners who roll special steels for automobile engineers report considerable caution as being exercised in the purchase of forward supplies or in negotiating for future requirements.

Galvanised Sheets.

Galvanised corrugated sheets of 24-gauge continue on the basis of £13 12s. 6d. per ton. Business is quiet, but a regular output is being maintained from the mills. Black sheets are in good request at recent price levels.

Scrap.

While the situation as regards steel scrap is easier, supplies are not plentiful and prices are maintained at the comparatively high level of £3 17s. 7d. per ton delivered South Wales. Wrought iron scrap is still difficult to obtain.

The Steel Sleeper Experiment.

Engineers, steel masters and industrialists generally in the Midlands and Staffordshire will await with much interest the results of the experiment which the L.M.S. and L.N.E. railway companies are making with steel sleepers. They realise that should it prove a success it will be a great boon to the steel trade. The susceptibility of steel sleepers to corrosion, especially in large industrial areas, such as the Midlands, where the air is badly polluted, is, of course, recognised; but it is asserted in this connection that as progress is made with the schemes in hand for minimising atmospheric pollution in industrial areas the chances of the general adoption of steel for railway sleepers will advance considerably. The chemical action on steel set up by slag ballast used by many of the railway companies has been a further factor against the use of steel, and that question will need the attention of railway engineering staffs.

Suggested Railway Electrification Scheme.

In view of the need for increased railway facilities in the Coventry area, suggestions have been put forward by the Coventry Chamber of Commerce for the electrification of the Coventry–Leamington and Coventry–Nuneaton branch railway lines. Mr. A. E. Dover, at a meeting of the Chamber this week, stressed the necessity for some such scheme and urged that, failing the electrification of the lines, the railway company should introduce Diesel type engines to give a quick service of trains between Leamington, Coventry and Nuneaton. Improvements to the Coventry railway station are also called for. The suggestions are to be considered by the Railway and Traffic Committee of the Chamber of Commerce, with a view to their being forwarded to the London, Midland and Scottish Railway Company.

Wolverhampton Omnibuses for Burton.

Wolverhampton is to benefit considerably by the action of the Burton Town Council in abandoning the whole of its remaining tramway system, for it is to be replaced, at any rate in part, by eighteen "Guy" motor omnibuses made by Guy Motors, of Wolverhampton. The cost of the vehicles is given as £23,560. This firm has supplied many of the important municipalities throughout the country with transport vehicles, and is just now very fully engaged.

Cast Iron Pipe Contracts.

Two important contracts for cast iron pipes for delivery to South America have been secured by the Stanton Ironworks Company, Ltd. One order is for some 40 miles of pipe for the Montevideo water supply, and the other for 10 miles of pipe for Rosario water supply. The pipes in both cases are chiefly in large diameters.

Improving Exports.

The improvement in exports which proved the feature of the Board of Trade returns for the month of May gives rise to considerable satisfaction in this district. That the heavy industries of the country should have taken such a prominent part in the advance is indeed cheering news. An advance of over a million sterling in exports of iron and steel, when compared with the corresponding month last year, is something to have achieved, and when one is able to add an advance of over three-quarters of a million in exports of machinery and one of one and three-quarter millions in vehicles, including locomotives, ships and aircraft, there is ample ground for self-congratulation. There was a small increase in the quantity of iron and steel imported during May this year over last. For the year to date the quantity imported is 1,105,597 tons, compared with 1,331,894 tons in the preceding year.

Production Returns.

An improved condition in both the iron and steel industries is indicated by the heavy figures of production for May. The pig iron produced amounted to 654,800 tons, which was some 40,000 tons better than in the month of April and was the best output for some time past. There was a net increase of seven furnaces in blast during the month. The output of 840,400 tons of steel ingots and castings also indicated the very much better position of manufacturers, who have been assisted by the rise in foreign prices. The output was not far below the March peak figure of 859,900 tons.

Death of Mr. William Wesson.

I regret to have to record the death, which took place on Tuesday, June 18th, of Mr. William Wesson, the founder of the firm of W. Wesson and Co., Victoria Iron and Steel Works, Moxley. Mr. Wesson was for seventy-seven years a workman and ironmaster, and when in 1898 he re-started the Victoria Ironworks the plant consisted of a forge and a mill. To-day the works are fitted with modern machinery, with cold-rolled strip and bright-drawn bar departments, as well as a galvanising department. Mr. Wesson retired from active participation in the works three years ago.

Warwickshire Miners' Wages.

The Warwickshire Collieries Joint Wages Board met at Birmingham to-day—Thursday—to receive an ascertainment for May and to consider the application of owners of certain Warwickshire collieries to revert from the wages basis of 43 per cent. to 32 per cent., which is contrary to the award of the independent chairman of the Joint Board. The Joint Wages Board is representative of both the owners and the men. At the time of writing the result of the Board's deliberations was not known.

The Workless.

While a slight drop in the number of persons out of work in the Midlands was recorded last week, the latest statistics show an increase of over 4000, bringing the grand total for the area to 154,711. In the Birmingham district the total of unemployed has increased in a week from 20,780 to 21,555. Increases are also recorded at Coventry, Stoke-on-Trent, Walsall, Cradley Heath, Wolverhampton, Dudley, Leamington, and Warwick. Leicester, Smethwick, and Wednesbury. Of the total unemployed in the area no less than 118,022 are men.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER.

Sharp Rise in Textile Machinery Exports.

A REMARKABLE advance compared with the corresponding period of last year in the overseas shipments of British textile machinery during May has resulted in an important increase in the five months' total compared with 1928, after a relatively poor start in the early months of the year. The total value during the month was £1,195,479, against £925,861 in May, 1928, and £1,179,835 in the corresponding month of 1927. Last month's total included 10,598 tons of spinning and twisting machinery, valued at £931,971, and 2035 tons of weaving machinery valued at £108,255. A feature of the month's export trade in this branch has been the extremely heavy takings by British India, and a sharp increase in shipments to Japan. British India retained first place among individual markets, with exports valued at £303,567, followed by Japan, £112,239; China, £98,104; France, £79,942; Russia, £78,019; South America, £60,576; the United States, £50,265; the Netherlands, £49,566; Germany, £42,490; and Australia, £26,072; the aggregate shipments to "other European countries" reaching the high figure of £230,648. Altogether exports during the completed five months of the present year amount to 55,867 tons, valued at £5,015,721, compared with 50,564 tons and £4,882,289 in the corresponding period of last year.

Industrial Results.

Although the balance-sheet of Platt Brothers and Co., engineers and textile machinists, of Oldham, discloses an appreciable improvement in the net profit compared with the previous financial year, the figure makes poor reading if one goes back, say, to the four years 1923–24 to 1926–27. In the period under review the profit increased from £73,291 in 1927–28 to £116,055, but after paying debenture interest and dividend on the preference shares, the balance of £58,412 (including £50,364 brought in from the previous accounts) is carried forward. The ordinary shareholders received no dividend for the year 1927–28, and none is to be paid for the past twelve months. The net profit in 1926–27 amounted to £257,582, and a dividend of 10 per cent., as in the two previous years, was paid. In 1923–24, however, the distribution was 15 per cent., the profit amounting to no less than £372,322. Unsatisfactory results are shown in the report for the fifteen months ending March 31st last of Bell Brothers, Manchester (1927), Ltd., manufacturers of water purification plant. Operations during that period resulted in the loss of £15,662, and after making provision for depreciation, reserve adjustments and income tax a debit balance of £24,921 is shown. It is proposed to reduce the capital of the company by £56,784 by writing down the value of the 7½ per cent. cumulative preference shares to 15s., and of the 1s. ordinary shares to 6d., at the same time increasing the yield on the preference shares to 10 per cent., and providing for the payment to the holder of each preference share of 20s. in the event of winding up.

More Russian Business.

M. Koniuknov, President of the Machinery Technical Syndicate of All Russia, is expected in the course of the coming week to pay a visit extending over two or three days to engineering establishments in Lancashire, principally, it is thought, to works specialising in the manufacture of textile machinery.

The Channel Tunnel.

Invited by the Association of British Chambers of Commerce to express an opinion as to the probable economic effects of the proposed Channel Tunnel, the directors of the Manchester Chamber of Commerce this week passed a resolution to the effect that they based their support of the scheme on the general principle that any extension of efficient facilities for transportation and communication must of necessity lead to extended trade. In their view, transport very often creates trade which has not hitherto existed. "A Channel Tunnel would undoubtedly increase passenger traffic between England and the Continent, and that of itself would foster trade, although the lines it might take cannot be forecast in detail. Freight transport would be definitely quicker than it is to-day, and this also would make possible trade which to-day is never even contemplated."

Another Water Supply Scheme.

Following closely upon the announcement of the Manchester Corporation's huge scheme at Haweswater comes the statement that Stockport Town Council has approved a scheme for the construction of two reservoirs, one of 900,000,000 and the other of 800,000,000 gallons capacity, at Fernilee and Errwood, in the Goyt Valley. It is proposed to apply for Parliamentary powers during the next session.

Artificial Silk Works for Preston.

Another new industry which Preston is hopeful of securing is the manufacture of artificial silk. Negotiations have been proceeding for some time between the

Corporation and Courtaulds, Ltd., in connection with a site at Red Star, about three miles outside the town, and the Corporation is said to be prepared to spend about £50,000 on sewerage to deal with the effluent. Nothing definite has yet been settled, though it is expected that if Courtaulds decide to establish the new works employment for about 5000 people will be provided.

Mining College Extension.

Lord Chelmsford, chairman of the Central Committee of the Miners' Welfare Fund, last week formally opened the new extensions to the Wigan Mining and Technical College, which have been completed at a cost of £37,000.

Railway Scholarship.

The Moon-Webb scholarship at the University of Liverpool, which is open to London, Midland, and Scottish Railway employees, has been awarded to Mr. H. N. Lintott, of Leigh, who is a twenty-year old apprentice at the Horwich Locomotive Works. The scholarship is worth £150 a year and is tenable for three years.

Non-ferrous Metals.

From the point of view of price movements, the non-ferrous metals market has had a comparatively uneventful week. Both copper and tin, which a week ago registered somewhat important advances, has lost some, though not the whole, of the ground gained, probably due to some extent to profit-taking on the part of speculators who are still in evidence on the market. Both standard and refined descriptions of copper have been in moderate request during the week, and after a period of mild fluctuations values on balance, compared with a week ago, are lower to the extent of 20s. to 30s. a ton, according to position. Tin, also, has been selling in moderate quantities, and although quotations in this section of the market are on lower levels, the loss has been a trifling one and amounts to no more than about 20s. a ton. At the moment of writing prices are still, from the producer's point of view, on the right side of £200. The industrial demand for lead has not been notably active during the past week, but values of both English and foreign metal are a few shillings dearer. With regard to spelter, current supplies are more than adequate to meet the moderate demand that is being experienced, and quotations in this section are, on balance, about 2s. 6d. lower.

Iron and Steel.

Interest of Lancashire foundries in new forward contracts for pig iron is less active, although orders for a fair aggregate tonnage have been placed here during the week, and deliveries continue reasonably satisfactory. Values are fully maintained at 73s. for Staffordshire No. 3; 72s. for Derbyshire, delivered to Manchester users; about 85s. for Middlesbrough; up to 92s. for Scotch; and 87s. for hematite, all delivered. In spite of an advance of 5s. in Lancashire bar iron, bringing Crown quality to £10 15s., and seconds to £10 5s., the demand is slow. One or two new contract orders for locomotive boiler and frame plates have been reported, and there is an insistent call for bright-drawn bars. In other respects, however, the steel market has been uneventful, and there has been no improvement in the weight of specifications placed by constructional engineers. Sections and joists are quoted at £8 2s. 6d.; general plates at £8 17s. 6d.; large bars at £9 2s. 6d.; boiler plates at £9 12s. 6d. to £9 17s. 6d., according to quality; and small re-rolled bars at from £8 5s. to £8 10s. per ton. On the whole, the market for foreign steel is steady at recent rates, although the buying movement is of little importance.

BARROW-IN-FURNESS.

Hematite.

The hematite pig iron trade continues to be fairly good, and makers are pretty well situated as regards orders. Customers are still placing orders for forward delivery, and their immediate requirements are fairly heavy. The one weak point is the fact that the local steel departments are not requiring so much iron, as the mills are not on full production by any means, and as a result more iron is available for the market. It is possible that some of this surplus iron in the shape of special qualities will find its way overseas. The home demand is steady and likely to be. Foreign business varies, but the Continent is a regular purchaser of better qualities, although the tonnage is not very heavy. The local iron ore trade is about the same, the outside demand being maintained. Foreign ore is in steady demand. The steel market is not bright, and orders are few and competition for them is keen. Neither works are at their full strength as regards railway material. Hoops continue to be in good demand, most of the trade being for overseas.

Submarines.

On Wednesday at Vickers-Armstrongs the first of the three submarines built to the order of the Chilian Government was handed over to the Chilian Naval Commissioner, Admiral Escobar. On Friday there is to be launched another submarine of the "P" class for the British Admiralty. At one time submarine launches were of a private character, but now the ceremony is largely attended by officials and representatives of the Admiralty.

SHEFFIELD.

(From our own Correspondent.)

An Uneven Situation.

THERE is still a lack of uniformity in the Sheffield steel trades, for, while improvements are reported in some directions, there are others in which the amount of work on hand is less than it was before Whitsuntide, while many cases of slackness are to be found. The basic side of open-hearth steel production is still busy, but the acid branch is very quiet and shows no advance. There has not been much change since the beginning of the year in the number of open-hearth furnaces in operation. Many of the acid furnaces have been standing for a considerable time. The absence of work in the railway axle, tire and spring departments is largely responsible for this. At present, the plants making these materials are better employed than they have been for some time, but there is a great shortage of bulk orders, on both home and overseas account. There is very little activity at the wagon building works.

Railway Plant Closed.

Cammell, Laird and Co., Ltd., who recently became, so far as its steel and allied businesses are concerned, a part of the English Steel Corporation, Ltd., has permanently closed the large and modern tire plant at its Penistone Works. This is a result of the rationalisation policy, and the work hitherto done at Penistone is to be transferred to the works of another firm in the English Steel Corporation—Taylor Brothers and Co., Ltd., Trafford Park, Manchester. This plant has an even larger capacity than that at Penistone, and enjoys the further advantage of being within easy reach of the sea. Messrs. Cammells are continuing to operate their steel plant at Penistone, but its employment is much below capacity. John Brown and Co., Ltd., whose report is out this week, state that orders for railway material were very limited during the twelve months ending March, and keen competition kept prices down to a low level. On the other hand, there is better news with regard to steel sleepers. The United Steel Companies, Ltd., which early in the year booked an order from the Southern Railway Company for 5000 tons of Sandberg steel sleepers, have now received trial orders for pressed steel sleepers from two other railway companies—10,560 for the London, Midland and Scottish Railway and 6000 for the London and North-Eastern Railway. Railway engineers all over the country are greatly interested in steel sleepers, and are carefully watching their behaviour. Seeing that about 4,000,000 new sleepers are used annually, the possibilities of the trade are very evident.

Some Good Departments.

Good business is being done in a number of specialities, but there are not many cases in which the demand is sufficient to keep the plants fully occupied. Among the active lines are automobile requirements, cold wrought strip, good class wires and wire rods, twist drills, hollow forged boiler drums, marine forgings, tool steel, stainless and corrosion-resisting steel and iron. In the last named item, expansion continues alike in output and in variety of application. Thos. Firth and Sons, Ltd., are now casting ingots of these metals up to a weight exceeding 20 tons. The forging department at the Atlas Works of John Brown and Co. is fully employed on large marine work, and the directors report that the results of the various departments at those works show an improvement on the previous year's figures.

Brown's Results.

There are several other interesting items in John Brown and Co.'s report. In its shipbuilding department the firm is now making progress on the following important orders:—Two cargo passenger liners for the Federal Steam Navigation Company and New Zealand Shipping Company; one 40,000 tons express Atlantic liner for Canadian Pacific Steamships, Ltd.; three high-speed Channel steamers for the London and North-Eastern Railway Company; and two destroyers for the British Navy. During the year the company delivered two cargo and passenger liners—the "Duchess of Richmond" and the "Duchess of York"—to Canadian Pacific Steamships, Ltd., and the first of three cargo and passenger liners on order for the New Zealand Shipping Company. The directors report some improvement in the coal trade during the last few months. Though results of colliery working in South Yorkshire are still far from satisfactory, they state, the operations of the Central Collieries Commercial Association have been of a very great benefit to the trade. The new coke oven plant at Rotherham Main is now almost completed. The profit for the year, after appropriating £50,000 from contingency account, is £87,262, as compared with a net profit for the previous year of £67,390. The preference dividend is being paid, and £90,925 carried forward, but for the fourth consecutive year there is no return on the ordinary shares. The contingency account, after the deduction of the £50,000 referred to, stands at £325,000. The directors remark that they "have before them the necessity for dealing with the book value of the fixed assets and investments, which are in excess of present values, notwithstanding the depreciation which has been applied in the past. The shareholders may, however, rest assured that the situation will be dealt with whenever the directors consider the proper time for doing so has arrived."

Barnsley Mining College.

An important Mining and Technical College is to be erected at Barnsley by the Town Council, which has accepted the tender of Mr. Charles Smith, of Barnsley, amounting to £79,660. This sum includes the building and £6500 for equipment. The Miners' Welfare Fund made a grant of £15,000 towards the cost of erecting and equipping the College. Of this grant, £10,000 is to be applied towards the £79,660, and application is to be made to the Ministry of Health for sanction to borrow £69,660.

Cutlery and Plate.

There is nothing very new to say about these trades, which are finding things, in the main, very quiet. There is still a large output of stainless steel table cutlery, but it is not equal to the average of past years, and a great proportion of it is of the cheaper class. Special lines, in the form of large contracts for hotel, ship, and restaurant equipment, continue to come forward, and provide valuable employment for a number of firms, but the ordinary shop-keeping trade is on an unsatisfactory scale. The trade in safety razors and blades continues to expand, and is one of the brightest features of the situation. The export trade in cutlery showed an improvement in May. The total value was £106,776, which was £20,000 in excess of the April figure, and more than £18,000 better than that of May last year, while the total for the five months showed an increase of £25,000, covering all sections of the trade. There was a fall in imports as compared with April, but the aggregate for the five months of this year shows an advance of £100,000. There is a large amount of German competition in cheap bazaar knives.

Bridging the Ouse.

The constructional work on the new bridge across the Ouse at Boothferry, near Goole, is now finished, and arrangements have been made for the taking over of the structure from the contractors—the Cleveland Bridge and Engineering Company, Ltd.—by the West Riding County Council. The bridge provides a valuable means of communication between the East and West Ridings. The date of the official opening is not yet announced, and the road-making works on both sides are not yet carried to the point at which they will be able to deal with the traffic that the opening of the bridge will bring. The new road on the Howden side will not be finished this month, while that on the Goole side will take still longer to complete.

Lincolnshire Water Problem.

There is a good deal of water shortage in the villages in the Holland section of Lincolnshire, particularly in the northern part of the area, and proposals are afoot for dealing with the matter. The formation of one or more Water Boards has been suggested. A resolution has been passed by the Regional Water Committee asking the Rural and Urban Councils of Holland to ascertain and report as to the condition of the water supply in their respective areas, and what sources of supply are available for the needs of parishes and districts which at present have no supply, or no adequate supply.

NORTH OF ENGLAND.

(From our own Correspondent.)

Famine in Cleveland Iron.

THE stringency in supplies of Cleveland pig iron is entirely unrelieved. The ironmasters are still more or less helpless in the grip of economic circumstances. There is urgent need of an increased output; indeed there is a positive famine in foundry pig iron, but output cannot be materially increased owing to the lack of ore and coke. The re-starting of two blast-furnaces at Jarrow this week—one on hematite and one on foundry iron—will do little to relieve a shortage which has become most serious, and whilst foreign prices are too high for the invasion of the Cleveland market by continental iron, contracts have already been fixed for the delivery here of many thousands of tons of Midland iron. The ironmasters are doing their best under difficult circumstances to meet the needs of their regular customers, but they are booked up for months to come and decline at present to accept further commitments. Merchants are also virtually sold out, and the following are more or less nominal quotations:—No. 1 Cleveland foundry, 75s.; No. 3 G.M.B., 72s. 6d.; No. 4 foundry, 71s. 6d.; and No. 4 forge, 71s.

Hematite Pig Iron.

East Coast hematite producers have no prompt parcels to offer and have substantial forward contracts, but second-hands have considerable quantities of marketable iron falling due to them under running contracts, and quotations do not rise above the comparatively low level at which they have stood for some little time. Hope of a rise in values has been dispelled by the enlargement of output. Business, however, is likely to keep on a moderately good scale, as both home and continental buyers are still in the market. Sales are reported at 74s. and upwards, according to quality.

Ironmaking Materials.

Transactions in foreign ore are few and small. Merchants are not so placed as to be able to sell at all extensively for anything like early delivery, and local consumers are well bought. Some of the latter are understood to have rearranged old contracts. Recognised market rates remain on the level of best Rubio ore at 23s., c.i.f. Tees, but sellers are not disposed to accept such terms. Blast-furnace coke quotations tend upward. The minimum price for good average qualities is 20s. per ton delivered to works in the North-East area.

Manufactured Iron and Steel.

Manufactured iron firms are well employed and are booking a few new orders. The situation as regards semi-finished steel is somewhat stringent. Producers have a lot of work on hand, and inquiries circulating promise to develop into business to an extent difficult to cope with. Output of finished steel is heavy and is likely to continue so. Values of all descriptions of material are firmly maintained.

Conversion of Liner to Oil Factory.

Work has been started by Palmer's Shipbuilding and Iron Company, Ltd., at their Hebburn graving dock on converting the large vessel "Hektoria," of 12,222 tons deadweight, into a floating whale oil factory. The vessel was formerly the White Star liner "Medic," and was purchased by a Norwegian firm. The contract, which is expected to be completed near the end of August, is a large and important one, and includes the removal of several of the deck houses, the building of an additional superstructure, fitting additional oil bunkers, altering the stern to form a tunnel through which the whales will be hauled, stiffening the stern to resist ice pressure, and installing boilers and other plant for dealing with the carcases of the whales and converting the blubber into oil.

The Coal Trade.

The tonnage difficulty has made itself felt in an acute form in the northern coal trade. While the strength of the coal market is undisturbed, there is a real difficulty in getting handy boats to clear off orders. This is a perplexing matter for exporters and an anxiety to the collieries. So far as the latter are concerned, if more boats be not forthcoming soon, there may be idle time at the pits. This would indeed be an ironical state of affairs in view of the busy condition of the coal trade. Plenty of cargoes to be shipped and not the adequate cargo space to accommodate them—that seems to be the situation just now. Many steamers usually trading on the North-East Coast are now in the Baltic and White Sea loading timber, and they would at this time be invaluable for carrying coal to Scandinavia and other parts of Northern Europe. The general tone of the coal market, however, continues steady, though higher rates are having to be paid for cargo space. In the Northumberland section the most interesting feature this week has been the fixing up of a number of contracts for the shipment of coal to Australia consequent upon the coal strike in New South Wales. Three cargoes amounting to between 20,000 and 25,000 tons of steam coal have been sold, and will be shipped as soon as the tonnage is available. There is every likelihood of this trade being increased. There is no quotable alteration in prices of steam coal. Best qualities are marked at 15s., though this figure might be shaded by second-hand holders to fill a prompt turn. Steam smalls are indicated unchanged at 9s. to 9s. 6d. for bests, 8s. 6d. for seconds, and 10s. for specials. In Durham county there is a strong market for best qualities of steams, large and small, and gas coals are doing well for next month and later. Production is being increased by some groups of pits and, while higher prices may not be obtained, the larger output helps to reduce costs. Coking coals remain in a very firm position, and sellers easily command late prices. Bunker coals are moving briskly for both ships' use and the coaling stations. Leading brands are well situated at 17s. to 17s. 6d., and ordinary kinds are quite steady at 16s. to 16s. 6d. Supplies of blast-furnace coke for home use are by no means plentiful and the price is firmer. Ordinary patent foundry coke is meeting with good support, and the market for gas coke is favourable, supplies not being so plentiful owing to lessened output in consequence of some producers obtaining gas from other undertakings and manufacturing less themselves. Coke prices are :—Gas coke, 22s.; patent oven coke, 20s. to 23s.; beehive or special foundry grades, 26s. to 28s.

Coal Mine Dispute Settled.

The Dawdon miners' stoppage, which has lasted nearly four months, came to an end on Monday, when the men agreed to accept the owners' terms and to resume forthwith. The settlement was the outcome of correspondence which passed between the Dawdon Miners' Lodge and Mr. Ramsay MacDonald, and the intervention of the Mines Department. The basis of settlement is that all cases in dispute are to be arranged by local negotiation by June 29th or by arbitration if no settlement has been reached by that date. The result of the local or arbitration settlement is to come into operation in the week commencing July 22nd.

Durham Mine to Re-open.

The old East Tanfield Colliery, near Stanley, is shortly to be re-opened by the owners of the West Stanley Colliery, who, it is stated, are taking the pit out of the hands of a liquidator at Newcastle. When the East Tanfield Colliery was closed down more than twelve months ago, owing to lack of orders, over 100 men and boys were thrown out of work. Shortly after the pit, which was owned by a Tanfield resident, passed into the hands of the liquidator. It is understood that steps will shortly be taken to re-equip the workings, and hopes are entertained that eventually the pit will absorb several hundreds of men and boys. Preparations are also being made to re-open the West Lees Colliery, Evanwood, which has been idle since March, 1927.

Another Contract for Armstrongs.

Sir W. G. Armstrong, Whitworth and Co., Ltd., have secured a further contract for a motor-driven oil tank vessel of 8800 tons deadweight for Scandinavian owners. The vessel is to be fitted with Armstrong-Sulzer two-cycle six-cylinder Diesel engines, which are to be manufactured by the company's marine engine department at Scotswood Works, Newcastle, who have other similar engines in hand for other vessels which the company is building at its shipyards.

LATER.

Contracts for four more vessels have been placed on the Tyne. They include two tankers, to be built by Sir W. G. Armstrong, Whitworth and Co., for Norwegian owners; while Hawthorn, Leslie and Co., are to build a twin-screw motor vessel, 453ft. long, for Holt and Co., of Liverpool, and a specially designed self-trimming collier, 225ft. in length, for Stephenson, Clarke and Co., of London.

SCOTLAND.

(From our own Correspondent.)

Dull Outlook.

ON the whole, the position in the steel, iron and coal trades continues unsatisfactory. Buying, as a rule, is very limited, and markets show no confidence, so far as the near future is concerned at least. In any case little change is likely to be apparent until the holiday season is over.

Steel.

Steelmakers are not booking orders with any freedom and many plants are employed far below capacity. In the heavy department the demand for plates is most disappointing, while business in sections, which has been comparatively good recently, shows signs of falling off. Heavy steel scrap has eased a little in price to about 75s. per ton.

Tubes.

So far as the tube trade is concerned, the position remains satisfactory. For a time tube makers were buying quantities of their raw material from local sources, but continental supplies are again plentiful and prices more advantageous.

Sheets.

The inquiry for sheets is decidedly better, and prices are easily maintained at recent levels. The market for galvanised descriptions is rather slow, however, owing to heavy stocks held abroad, but an improvement is expected within a few weeks when these stocks are reduced. The home price for galvanised corrugated sheets, 24 g., is now £13 17s. 6d. per ton, with export still from £13 12s. 6d. to £13 15s. per ton.

Iron.

The situation in the bar iron trade is no better than it has been for some time, and prices still remain unchanged despite advances elsewhere. Re-rolled steel, too, has developed a quieter aspect, and in all probability prompt business could be placed somewhat below the existing quotations of £8 home and £7 15s. per ton export.

Pig Iron.

Business in hematite and basic is small but fairly steady, but foundry qualities have a poor market. Minimum prices are maintained as follows :—Hematite, 78s. at steelworks; No. 1 foundry, 77s.; No. 3 foundry, 74s. 6d., at furnaces; and basic, 76s., all for home delivery.

Scrap.

Scrap material has become a little more plentiful, and cast iron is now quoted round about 71s. 6d. per ton.

Coal.

In the Fifeshire district the recent improved demand for steam coal is maintained, but elsewhere the position is, if anything, worse than it was, especially in Lanarkshire, where the collieries feel most acutely the falling off in home demands and the lack of export business. Pits are still being closed down, and supplies remain more than adequate. Consequently it is practically impossible to maintain present prices for shipment, and most, if not all, collieries are prepared to grant concessions to exporters placing prompt orders. Lothians steams, too, are not too well placed, and, as in the West of Scotland, washed materials are the strongest feature, supplies being scarce owing to restricted outputs of round coal. Aggregate shipments amounted to 248,001 tons, against 215,782 tons in the preceding week and 245,404 tons in the same week last year. It is reported that the Danish State Railways have contracted for 20,000 tons of Cowdenbeath–Lochgelly coal for shipment over the next six months.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Coal Trade Conditions.

ALTHOUGH to all outward appearances there is little or no change in the conditions of the steam coal trade, there is a feeling that the market has a much steadier undertone, and that an improvement will before long become manifest if tonnage shows up more plentifully than is the case at the moment. Shipments last week were over half a million tons, as compared with just over 450,000 tons the previous week, and this advance was recorded in the face of the fact that towards the end of the week tonnage was far below what was required. There were nineteen idle tipping appliances at the various docks and only one steamer waiting to berth on Saturday last, while on Tuesday of this week there were sixteen idle appliances, while ten steamers were waiting to get into berth. Chartering operations have been on a fair scale, but not exactly what can be described as active, although it is interesting to note that some very large steamers have been fixed to load in this district. The trouble for charterers has been and is that handy-sized vessels are scarce, and much to their discomfiture, outward rates of freight have hardened for the comparatively few steamers that are available. There is quite a good demand for tonnage, not only for French coast and Bay ports, but especially for Belgium, which shows that consumers in the latter country are unable to satisfy their requirements in other coal producing areas, and as a consequence are looking to South Wales for supplies. Apart from this, however, there is evidence that buyers in other directions are showing a desire to cover their needs, and business has been done as far ahead as into 1930. It is also reported that there are inquiries for coals for Australia and New Zealand, but the belief is entertained that the business if it materialises will go to the North Country and not to Wales. Some useful business is pending in respect of coals required for Spain and Portugal and South America.

May Coal Exports.

The Customs returns respecting coal exports for the month of May came as a pleasant surprise, as they exceeded expectations. The total for the whole of the country was 5,328,261 tons, that is cargo and bunker shipments, and this formed the highest total for any month since July, 1924. South Wales shared in the improvement, as the total for this district came to 2,123,883 tons, which was the highest figure since May, 1927, while the declared f.o.b. value of £1,947,710 was the highest figure since March, 1927. Compared with the figure for April the average f.o.b. value of the coals shipped during May marked a decline of 1¼d. per ton, as the price worked out at 18s. 4d., as against 18s. 5¼d.

Coal and Iron Trade Losses.

During last week-end two important industrial concerns in this district issued their annual reports for 1928, and in both cases very heavy trading losses were disclosed. These concerns were the Amalgamated Anthracite Collieries, Ltd., and the Ebbw Vale Steel, Iron and Coal Company, Ltd. Their combined deficit amounted to over £716,000. In the case of the Amalgamated Anthracite Collieries, Ltd., the debit balance, including interest and other charges, came to £309,461, and in that of the Ebbw Vale Company the deficiency, including interest and other charges, was £407,394.

Dock Charges.

The decision of the Great Western Railway Company to apply to the Rates Tribunal for powers to increase its charges at South Wales docks is, as expected, meeting with opposition from traders. The Newport shipowners and the Newport Harbour at meetings recently held decided to protest to the Ministry of Transport, it being pointed out that as recently as March of this year the Great Western Company sought powers to stabilise the 60 per cent. increase for a period of five years. The company was unsuccessful in its application before a Select Committee of the House of Commons, and nothing has happened during the past two months to justify an increase; indeed, the benefit which must accrue to the docks as a result of the Derating Act and the general improvement in coal shipments warrants, it is held, a decrease, particularly as shipping freights are only 11 per cent. above the pre-war average, although dock charges are already from 60 to 100 per cent. above those ruling in 1913. The claim is that instead of there being an increase there should be a decrease in charges.

Coal Trade Agreements.

While it is difficult to forecast what may be the position towards the end of this year respecting the question of a new agreement between the coalowners and the miners, it is to be hoped that the tendency to create an atmosphere of crisis will be restrained, as this in itself is a severe handicap to business, and may possibly drive away to competing coalfields orders for hundreds of thousands of tons. Past experience has invariably shown this to be the case. So far as the craftsmen in this district are concerned, the matter of a new agreement is being approached in a very reasonable spirit. The Executive Committee of the South Wales Enginemen, Boilermen and Craftsmen's Association met at the end of last week and considered, among other matters, the important one of a new agreement, and proceeded to draft proposals which will be finally considered and either adopted or amended at a delegate conference to be held towards the end of July. According to the general secretary of this organisation, it was futile to anticipate that the Welsh mining industry could benefit by a national agreement or by any outside interference. The ideal which should be aimed at was to make such arrangements as would secure peace for ten years.

Current Business.

The tone of the market is slightly steadier all round so far as large coals are concerned. These grades, with a few exceptions, have been very plentiful, indeed excessive, and only the operation of the minimum price scheme has prevented some of the coals falling. The position now is, however, a shade better, though there is still room for improvement. So far as sized coals and smalls are concerned, the market remains firm. Coke moves off freely, and patent fuel is about steady. Pitwood has improved and is about 27s. 6d. to 28s.

CATALOGUES.

EDGAR ALLEN AND CO., Ltd., Sheffield.—New booklet on "Maxilvry" patented stainless steel.

ASH COMPANY, 63, Lincoln's Inn-fields, W.C. 2.—Particulars of the "Hydrojet" system of ash handling.

WADKIN AND CO., Leicester. — Catalogue 117 of the "Wadkin" semi-automatic wood miller.

J. STONE AND CO., Ltd., Deptford, S.E. 14.—A catalogue dealing with Stone's bronzes and white metals.

JAMES KEITH AND BLACKMAN COMPANY, Ltd., 27, Farringdon-avenue, E.C. 4.—A leaflet on "Blackman" ventilating fans.

DAVID BROWN AND SONS (HUDDERSFIELD), Ltd., Lockwood, Huddersfield.—A booklet entitled "Worm Gear Transmission."

SWITCHGEAR AND COWANS, Ltd., Elsinore-road, Old Trafford, Manchester.—Leaflet "'S and C' Automatic Controls for Road Traffic."

GENERAL ELECTRIC COMPANY, Ltd., Magnet House, Kingsway, W.C. 2.—A number of revision sheets for the catalogue "Everything Electrical"

BRITISH INSULATED CABLES, Ltd., Prescot, Lancs.—Two descriptive catalogues of "Prescot" electric resistance seam welders and spot welders.

BROOKHURST SWITCHGEAR, Ltd., Northgate Works, Chester.—Booklet, "Electric Control of Ships' Auxiliaries," showing several recent improvements.

"SENTINEL" WAGGON WORKS, Ltd. Iddesleigh House, Caxton-street, S.W. 1—A small book illustrating special purposes for which "Sentinel-Cammell" rail cars may be used.

THOMAS ROBINSON AND SON, Ltd., Rochdale.—The Robinson patented vacuum dust collecting system. This apparatus is intended for the automatic removal of refuse from saw mills and woodworking factories.

TECHNOLOGICAL INSTITUTE OF GREAT BRITAIN, Temple Bar House, E.C. 4.—"The Engineer's Guide to Success," describing the Institute's organisation for correspondence training in engineering and allied industries.

BRITISH ALUMINIUM COMPANY, Ltd., Adelaide House, King William-street, E.C. 4.—"Aluminium: Its Production and Application," a reprint of a lecture before the Rugby Engineering Society, by Mr. E. T. Painton.

METROPOLITAN-VICKERS ELECTRICAL COMPANY, Ltd., Trafford Park, Manchester.—Descriptive Leaflet 460/2–1 on Central Flow Surface Condensers; also Publication No. 7977/6 entitled "Electrification Work for British Railways."

Current Prices for Metals and Fuels.

IRON ORE.

N.W. COAST—	
(1) Native	19/6 to 21/-
(1) Spanish	24/-
(1) N. African	24/-
N.E. COAST—	
Native	18/- to 21/-
Foreign (c.i.f.)	23/6

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) SCOTLAND—		
Hematite	3 16 0	—
No. 1 Foundry	3 17 0	—
No. 3 Foundry	3 14 6	—
N.E. COAST—		
Hematite Mixed Nos.	3 14 0	3 14 0
No. 1	3 14 6	3 14 6
Cleveland—		
No. 1	3 15 0	3 15 0
Silicious Iron	3 15 0	3 15 0
No. 3 G.M.B.	3 12 6	3 12 6
No. 4 Foundry	3 11 6	3 11 6
No. 4 Forge	3 11 0	3 11 0
Mottled	3 10 6	3 10 6
White	3 10 6	3 10 6
MIDLANDS—		
(3) Staffs.—	(*Delivered to Station*)	
All-mine (Cold Blast)	—	
North Staffs. Forge	3 11 0	
,, ,, Foundry	3 13 6	
(3) Northampton—		
Foundry No. 3	3 10 0	—
Forge	3 6 0	—
(1) Derbyshire—		
No. 3 Foundry	3 18 6	—
Forge	3 14 6	—
(3) Lincolnshire—		
No. 3 Foundry	3 12 6	—
No. 4 Forge	—	—
Basic	—	—
(4) N.W. COAST—		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	4 4 6 (*a*) / 4 7 6 (*b*) / 4 11 0 (*c*)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
SCOTLAND—		
Crown Bars	10 5 0	9 15 0
Best	—	—
N.E. COAST—		
Iron Rivets	11 10 0	
Common Bars	10 15 0	
Best Bars	11 5 0	
Double Best Bars	11 15 0	
Treble Best Bars	12 5 0	
LANCS.—		
Crown Bars	10 15 0	
Second Quality Bars	10 5 0	
Hoops	13 0 0	
S. YORKS.—		
Crown Bars	11 0 0	
Best Bars	11 10 0	
Hoops	12 0 0	
MIDLANDS—		
Crown Bars	10 0 0	
Marked Bars (Staffs.)	12 0 0	
Nut and Bolt Bars	9 0 0 to 9 5 0	
Gas Tube Strip	10 17 6 to 11 0 0	

STEEL. (*d*)

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) SCOTLAND—		
Boiler Plates	10 10 0	10 10 0
Ship Plates, ¾in. and up	8 12 6	7 12 6
Sections	8 2 6	7 2 6
Steel Sheets, ¼in.	9 0 0	8 12 6
Sheets (Gal. Cor. 24 B.G.)	13 17 6	13 12 6 to 13 15 0

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. COAST—		
Ship Plates	8 12 6	—
Angles	8 2 6	—
Boiler Plates	12 15 0	—
Joists	8 2 6	—
Heavy Rails	8 10 0	—
Fish-plates	12 0 0	—
Channels	10 5 0	£9 to £9 5s.
Hard Billets	8 2 6	—
Soft Billets	6 17 6	—
N.W. COAST—		
BARROW—		
Heavy Rails	8 5 0	—
Light Rails	8 10 0 to 8 15 0	—
Billets	6 15 0 to 9 10 0	—
MANCHESTER—		
Bars (Round)	9 2 6	—
,, (Small Round)	8 5 0 to 8 10 0	—
Hoops (Baling)	10 0 0	9 15 0
,, (Soft Steel)	9 0 0	8 15 0
Plates	8 17 6 to 9 2 6	—
,, (Lancs. Boiler)	9 12 6 to 9 17 6	—
SHEFFIELD—		
Siemens Acid Billets	9 10 0	—
Hard Basic	9 2 6 and 9 12 6	—
Intermediate Basic	7 12 6 and 8 2 6	—
Soft Basic	7 0 0	—
Hoops	9 10 0 to 9 15 0	—
Soft Wire Rods	8 10 0	—
MIDLANDS—		
Small Rolled Bars	8 7 6 to 8 15 0	—
Billets and Sheet Bars	6 10 0 to 6 12 6	—
Sheets (20 W.G.)	11 10 0 to 12 0 0	—
Galv. Sheets, f.o.b. L'pool	13 12 6 to 13 15 0	—
Angles	8 2 6	—
Joists	8 2 6	—
Tees	9 2 6	—
Bridge and Tank Plates	8 17 6	—
Boiler Plates	9 15 0 to 9 17 6	—

NON-FERROUS METALS.

SWANSEA—	
Tin-plates, I.C., 20 by 14	18/6 to 18/9
Block Tin (cash)	201 5 0
,, ,, (three months)	204 12 6
Copper (cash)	74 13 9
,, (three months)	74 10 0
Spanish Lead (cash)	23 18 9
,, ,, (three months)	23 16 3
Spelter (cash)	26 3 9
,, (three months)	26 0 0
MANCHESTER—	
Copper, Best Selected Ingots	79 5 0
,, Electrolytic	85 0 0
,, Strong Sheets	110 0 0
,, Tubes (Basis Price), lb.	0 1 3½
Brass Tubes (Basis Price), lb.	0 1 1½
,, Condenser, lb.	0 1 3½
Lead, English	25 10 0
,, Foreign	24 0 0
Spelter	26 5 0
Aluminium (per ton—raw ingot)	£95

FERRO ALLOYS.

	Per Ton.	Per Unit.
Tungsten Metal Powder	2/11 per lb.	
Ferro Tungsten	2/9 per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£25 0 0	7/6
,, ,, 6 p.c. to 8 p.c.	£24 0 0	7/-
,, ,, 8 p.c. to 10 p.c.	£23 10 0	6/-
,, ,, Specially refined		
,, ,, Max. 2 p.c. carbon	£36 0 0	12/-
,, ,, ,, 1 p.c. carbon	£38 0 0	15/-
,, ,, ,, 0·70 p.c. carbon	£42 0 0	17/-
,, ,, ,, carbon free	1/2 per lb.	
Metallic Chromium	2/6 per lb.	
FerroManganese (per ton)	£13 15 0 for home; £13 10 0 for export	
,, Silicon, 45 p.c. to 50 p.c.	£12 0 0 scale 5/- per unit	
,, ,, 75 p.c.	£19 10 0 scale 6/- per unit	
,, Vanadium	13/- per lb.	
,, Molybdenum	4/- per lb.	
,, Titanium (carbon free)	1/- per lb.	
Nickel (per ton)	£170 to £175	
Ferro-Cobalt	9/4 per lb.	

FUELS.

SCOTLAND.

(*Prices not stable.*)

	Export.
LANARKSHIRE	
(f.o.b. Glasgow)—Steam	13/-
,, ,, Ell	14/-
,, ,, Splint	15/6 to 16/-
,, ,, Trebles	14/6
,, ,, Doubles	13/3
,, ,, Singles	12/6
AYRSHIRE—	
(f.o.b. Ports)—Steam	13/3
,, ,, Jewel	16/6
,, ,, Trebles	13/9
FIFESHIRE—	
f.o.b. Methil or Burntisland—Steam	12/- to 14/6
Screened Navigation	17/6
Trebles	14/6 to 15/6
Doubles	13/6
Singles	12/-
LOTHIANS—	
(f.o.b. Leith)—Best Steam	13/-
Secondary Steam	12/6
Trebles	14/-
Doubles	13/6
Singles	12/3

ENGLAND.

(8) N.W. COAST—	
Steams	24/- to 25/-
Household	38/- to 51/-
Coke	23/6 to 24/-
NORTHUMBERLAND—	
Best Steams	15/- to 15/6
Second Steams	13/6 to 13/9
Steam Smalls	9/6 to 10/6
Unscreened	13/- to 13/3
Household	21/- to 26/-
DURHAM—	
Best Gas	16/6 to 16/9
Second	16/- to 16/6
Household	21/- to 27/-
Foundry Coke	22/- to 28/-
SHEFFIELD—	Inland.
Best Hand-picked Branch	27/- to 28/6 —
Derbyshire Best Bright House	20/- to 23/- —
Best House Coal	19/6 to 20/6 —
Screened House Coal	17/6 to 18/6 —
,, ,, Nuts	16/- to 17/6 —
Yorkshire Hards	15/6 to 16/6 —
Derbyshire Hards	15/6 to 16/6 —
Rough Slacks	8/6 to 9/6 —
Nutty Slacks	6/- to 7/- —
Smalls	2/- to 4/- —
Blast-furnace Coke (Inland)	14/6 at ovens —
Furnace and Foundry Coke (Export), f.o.b.	20/- to 21/-

(9) SOUTH WALES.

CARDIFF—	
Steam Coals :	
Best Smokeless Large	19/9 to 20/-
Second Smokeless Large	19/6 to 19/9
Best Dry Large	19/- to 19/6
Ordinary Dry Large	18/- to 18/6
Best Black Vein Large	18/6 to 18/9
Western Valley Large	18/3 to 18/6
Best Eastern Valley Large	18/- to 18/3
Ordinary Eastern Valley Large	17/3 to 17/9
Best Steam Smalls	13/6 to 14/-
Ordinary Smalls	12/6 to 13/-
Washed Nuts	20/- to 23/6
No. 3 Rhondda Large	20/- to 21/-
,, ,, Smalls	15/6 to 16/-
No. 2 ,, Large	17/3 to 17/9
,, ,, Through	16/- to 17/-
,, ,, Smalls	13/6 to 14/-
Foundry Coke (Export)	26/6 to 36/-
Furnace Coke (Export)	21/- to 23/-
Patent Fuel	20/- to 21/6
Pitwood (ex ship)	27/3 to 27/9
SWANSEA—	
Anthracite Coals :	
Best Big Vein Large	33/- to 36/6
Seconds	27/6 to 30/-
Red Vein	23/- to 27/-
Machine-made Cobbles	40/- to 44/-
Nuts	40/- to 44/-
Beans	23/6 to 25/6
Peas	17/9 to 18/6
Breaker Duff	9/- to 9/6
Rubbly Culm	10/- to 10/3
Steam Coals :	
Large	18/- to 19/-
Seconds	17/- to 18/-
Smalls	10/6 to 13/-
Cargo Through	15/6 to 16/6

(1) Delivered. (2) Net Makers' Works. (3) f.o.t. Makers' Works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire and Ayrshire.

(6) Home Prices—All delivered Glasgow Station. Boiler Plates 10/- extra delivered England. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated. coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. (*a*) Delivered Glasgow. (*b*) Delivered Sheffield. (*c*) Delivered Birmingham. (*d*) Rebate 12/6 joists and 10/- all other materials if home consumers confine purchases solely to British products.

French Engineering Notes.

(From our Correspondent in Paris.)

Trade Activity.

In most branches of the engineering trades orders are being distributed more freely, and, for the first time for some years, wagon builders are generally well employed, the railway companies having recently placed a number of orders. The order for all-steel postal vans, which was held up pending an inquiry into the alleged failure of certain metallic coaches, has been given out. Builders in France as well as in Belgium and Czecho-Slovakia have been approached by the German association with a view to the formation of an international cartel of wagon builders. The arrangements for the creation of a cartel in Germany appear to be well advanced. The machine tool firms are busy, and the Germans are putting on the market a considerable number of second-hand grinding, gear-cutting and other special machines that do not come within the scope of French makers. The trade activity is also dependent to a large extent upon the results of the forthcoming meeting of the Steel Cartel in Paris. The cartel is likely to steer clear of the difficulties that beset it until October next, when its fate will be decided by the failure or otherwise to renew the steelmakers' association in Germany. Much is made of this possibility by the Germans, who are using it as a means of forcing the hands of the other members of the cartel and inducing them to increase the German quota by 5 per cent., thereby making it 48·25 per cent., and to remove all restrictions on the German exports of steel. German steel makers had agreed to limit their exports of steel to something less than a million tons every three months, as compensation to other members for remitting the penalties the Germans had incurred for an excess of production to meet the heavy home demand, but now that these requirements have declined, and steel makers have to look to foreign markets, they find it impossible to continue the arrangement. It is believed that at the forthcoming meeting the Germans will obtain satisfaction on these points.

Electric Locomotives.

The question of settling upon definite types of locomotives for the electrified lines continues to occupy the attention of the railway companies which are experimenting with different systems of locomotives that are, on the whole, giving satisfactory results. The main trouble appears to be the effect they have on the permanent way. It is found that the low centre of gravity of American locomotives, in which the rotors are on the axles, is prejudicial to the permanent way, especially when the bogies are not carried on one rigid frame, and the flexibility aimed at by American designers actually sets up a succession of lateral shocks on the rails that necessitate frequent adjustments at the curves. It is therefore preferred to employ a type of locomotive with rigid frame. So far as the permanent way is concerned, the best results are obtained with geared motors, which give a higher centre of gravity to the locomotive. The French and Hungarian locomotives are of that type, and the only criticism made against them is that they are too light. Experience is determining the final type which is probably even now being evolved. By increasing the weight of the locomotives to provide for the greater loads and higher speeds, it is probable that heavier rails will also have to be used. On the Orleans electrified system the weight of the rails is 46 kilos. per metre—say, 92¼ lb. per yard.

Industrial Tendencies.

The annual report of the Comité des Forges upon the iron and steel industries is always awaited with interest, since it gives an accurate view of the situation and an idea of how iron and steel makers regard the future. The fact that the production of pig iron in 1928 was 10,097,000 tons and of steel 9,387,000 tons, representing increases respectively of 771,000 tons and 1,081,000 tons on the previous year, and that the exports of metallurgical products amounted to 4,426,000 tons, a decline of 550,000 tons as compared with the figures for 1927, is an indication of a larger home consumption. It also reflects the changes that have taken place in the conditions of foreign trade as the result of territorial readjustments, whereby Alsace and Lorraine returned to France, Upper Silesia was transferred to Poland, and Luxemburg entered the Belgian Union. The home consumption of France represents only 61 per cent. of the production, including the Saar, whereas in 1913 it was 92 per cent. In Germany, on the other hand, the home consumption was 85 per cent. of the production as compared with 72 per cent. in 1913. Therefore, something must be done to increase the home production which, at present, is only 170 kilos. per head of population, and the Comité des Forges has created an Office Technique pour l'Utilisation de l'Acier with a view to seek out and encourage new outlets for steel, particularly for the construction of buildings. The increased home consumption is due in a large measure to the call for material for public works, and if it is to benefit French makers, the Comité des Forges insists that the importation of material from Germany on account of reparations should be considerably restricted.

Naval Manœuvres.

Having already made great progress with the reconstitution of the Fleet, the French Government aims at maintaining it in a high state of efficiency. For that purpose the vessels are sent on long cruises to colonial and foreign ports, and for the first time there has been a resumption of the manœuvres that were necessarily interrupted when the Navy emerged from the war a shadow of its former power. A division of the first squadron sailed for Algeria from Barcelona, which it visited on the occasion of the opening of the Exhibition, and on the way carried out manœuvres with the remaining divisions. Meanwhile, the second squadron had sailed from Brest and the first squadron set out to meet it and engage in operations, principally scouting and firing practice, between Gibraltar and Casablanca. Both squadrons then sailed to Morocco, which they subsequently left to carry on the second part of the manœuvres. The seaplane carrier "Bearn" took a prominent part in the operations.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

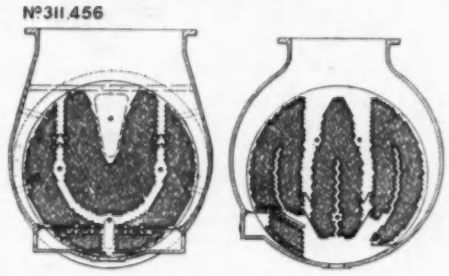
The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

CONDENSERS AND FEED-WATER HEATERS.

311,456. February 13th, 1928.—STEAM CONDENSERS, The English Electric Company, Ltd., 28, Kingsway, London, W.C. 2; and J. W. Mather, Willans Works, Rugby.

The inventors advocate the subdivision of the tubes of a

No 311,456



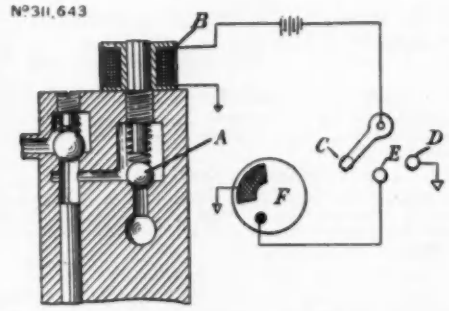
surface condenser in such a manner that the group for each pass of the circulating water is of approximately U shape. The illustrations are of a two-pass and of a three-pass condenser.—*May 13th*, 1929.

INTERNAL COMBUSTION ENGINES.

311,643. November 16th, 1928.—CONTROLLING THE SUPPLY OF FUEL TO ENGINES, G. Held, 14, rue Cans Ixelles, Brussels, Belgium.

This fuel injection gear is reminiscent of the old "hit-and-miss" system of governing gas engines. That is to say, the inventor appears to prefer the injection of a full charge of fuel occasionally, according to the load on the engine, rather than its graduation stroke by stroke. He effects his purpose by the electromagnetic control of the fuel pump suction valve A. The

No 311,643



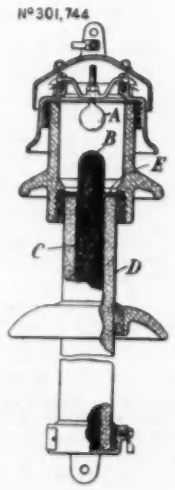
electromagnet is shown at B and tends, when energised, to keep the valve off its seat. The magnet has two alternative circuits and an open position. If the switch is at C the magnet is not energised and the engine works according to the strokes of the fuel pump. If contact is made at D the magnet is continuously energised, the valve is held up and the engine stops. If the switch is turned to E the contact breaker F comes into action and the valve is held open intermittently according to the speed of revolution of the breaker.—*May 16th*, 1929.

TRANSMISSION OF POWER.

301,744. December 3rd 1928.—ELECTRIC DISCHARGE DEVICES, *The British Thomson-Houston Company, Ltd., of Crown House, Aldwych, London, W.C. 2.*

This specification describes a lightning arrester comprising a

No 301,744



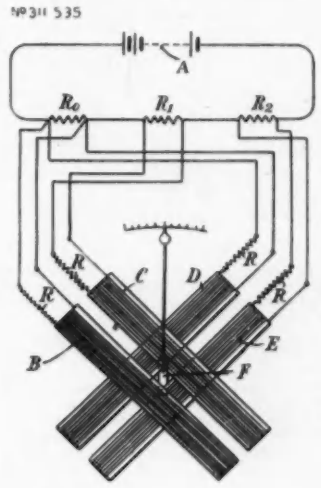
pair of electrodes A and B forming a spark gap. As the illustration shows, one of the electrodes B is hollow and is filled with pellet C. One of the objects of the invention is stated to be to provide a pellet arrester which will not allow dust from the pellet chamber to reach the spark gap chamber. Another object is to shorten the pellet chamber within the porcelain container D. A flange E separates the main part of the pellet chamber from the spark gap chamber.—*May 16th*, 1929.

MEASURING AND TESTING INSTRUMENTS.

311,535. April 24th, 1928.—APPARATUS FOR INDICATING THE EFFICIENCY OF SURFACE CONDENSERS, Robert Hodson Parsons, of 52, rue Emm Van Driessche, Brussels.

Resistances R_0, R_1 and R_2 are connected in series with a battery A. These resistances have a large temperature resistance coefficient, and they are placed in the paths of the incoming steam, the cooling water entering the condenser and the cooling water flowing out from the condenser. Thus the resistances R_0, R_1 and R_2 are proportional to the three temperatures concerned. The ends of the resistances are connected to a galvanometer having four fixed coils B C D and E, the coils B and C being at

No 311,535



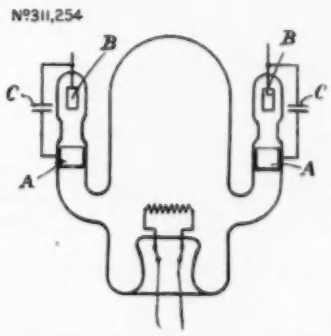
right angles to D and E. An iron armature F is suspended at the centre of the coils, and carries an indicating pointer moving over a scale. Since the four coils have very little resistance, fixed resistances R are connected to each coil. The movement of the pointer G is proportional to the ratio $\frac{T_0 - T_1}{T_0 - T_2}$, where T_0 is the steam temperature at the inlet of the condenser, T_1 the inlet temperature of the circulating water and T_2 the outlet temperature of the circulating water. It will thus be seen that if the quantity of cooling water be maintained constant the instrument will measure the efficiency of the condenser.—*May 16th*, 1929.

MISCELLANEOUS.

311,254. February 6th, 1928.—ELECTRIC RECTIFIERS, *Stanley Gordon Sinclair Dicker, of 20 to 23, Holborn, London, E.C. 1.*

According to this invention, the starting voltage of a gas-filled rectifier having an incandescent cathode and one or more anodes is reduced without prejudicially decreasing the back ignition

No 311,254

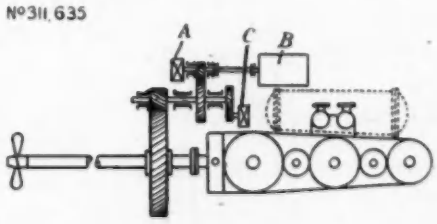


voltage by arranging one or more conducting members between the cathode and an anode, the conducting members consisting of wires or rods B connected to the anode through a condenser C which may be variable. Preferably the conducting members A are composed of molybdenum.—*May 6th*, 1929.

311,635. October 22nd, 1928.—TURBO-RECIPROCATING POWER PLANTS, Dr. G. Bauer, 82, Mittelweg, Hamburg, Germany.

The inventor aims at securing the best efficiency possible from a combination of a reciprocating engine and an exhaust turbine by maintaining a high vacuum. He points out that it is difficult

No 311,635



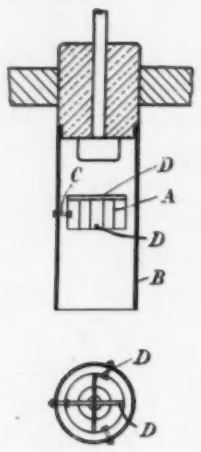
to increase the vacuum produced by the existing air and circulating pumps of the engine, so he provides an additional circulating pump A directly driven by the exhaust turbine B and an extra air pump C driven off the intermediate gearing. No hint is given as to whether the additional pumps work in series or in parallel with those of the reciprocating engine.—*May 16th*, 1929.

292,075. June 8th, 1928.—MERCURY VAPOUR RECTIFIER, Aktiengesellschaft Brown, Boveri & Cie., of Baden, Switzerland.

Experience and observation have shown that a back-fire in a mercury vapour rectifier may be prevented by retarding the

formation of the reverse are following the extinction of the forward arc. According to this invention, grids are placed in the path of the arc. The grids A are composed of a metal which does not amalgamate with mercury, such, for example, as iron,

No 292,075

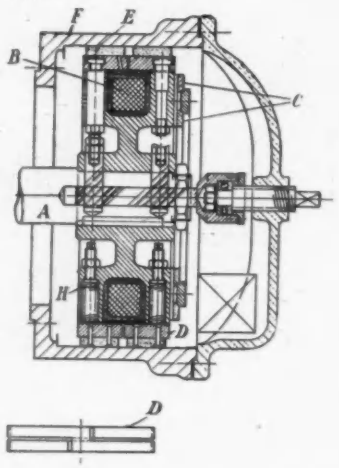


and they are electrically connected to the anode shield B by conducting bolts C. As shown in the lower illustration, the grids are formed of concentric sleeves or tubes which are connected together by stays D.—*May 16th*, 1929.

311,464. February 16th, 1928.—IMPROVEMENTS IN ELECTRO-MAGNETIC BRAKES, Wilfrid L. Spence, of 35, Kenilworth-road, Leamington.

The shaft A carries an electromagnet B which is supplied with current through slip rings. The iron armature C is constructed on similar lines to a two-turn piston ring, as shown in the lower illustration. The whole magnet system with fabric material E

No 311,464

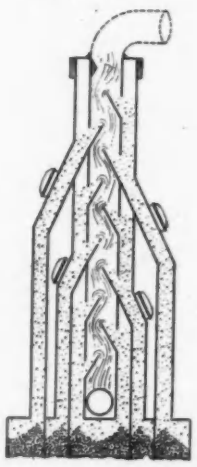


rotates within the casing F which forms a brake drum. Normally the armature expands sufficiently to keep the brake applied, but when the magnet is excited the armature is attracted and contracted, with the result that the brake is freed, whilst in the event of the speed becoming excessive the armature moves outwards and the brake is applied. Adjustable springs H may press the armature outwards or alternatively pull it in.—*May 16th*, 1929.

311,639. October 29th, 1928.—REMOVING DUST FROM GASES, C. H. Schol, Allendorf (Dillkreis), Bahnstation Haiger, Germany.

This apparatus is intended for such purposes as the cleaning of blast-furnace gases and, in view of the illustration, needs little

No 311,639

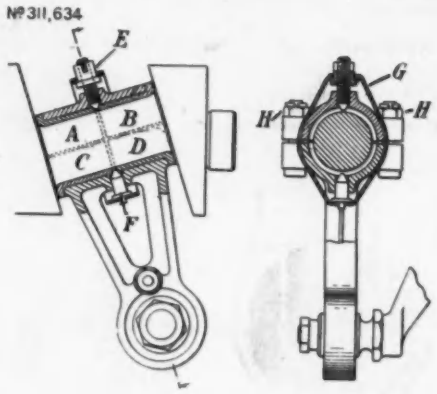


description, but the following phrase taken from the principal claim is pertinent. "The apparatus is characterised in that the current to be purified is passed through a long chimney or conduit provided alternately on either side with inwardly projecting inclined planes having edges so disposed that the fluid current is compressed between the successive inwardly projecting edges of the planes and the opposite wall of the chimney, and expands unilaterally above each of the said edges so that whirls are produced and the material in suspense is expelled and directed towards an escape pipe arranged behind each plane and leading to a storage pocket outside the chimney."—*May 16th*, 1929.

311,634. October 19th, 1928.—BIG END BEARINGS, C. Clench, Arrol-Johnston and Aster Engineering Company, Ltd., Dumfries, Scotland.

This big end bearing is more specially applicable to the "wobble" style of crank shaft, such as those used in connection with the sleeve valves of internal combustion engines. The object of the inventors is to provide for end wear on the brasses.

No 311,634



For this reason the brasses are made in quarters, as shown at A B C D. At their intersections there are provided conically pointed pegs E and F. The peg E is screwed, as shown, and the peg F plain. The two are worked in unison to force the quarters of the brasses apart by means of the strap G. The bolts H H serve to secure the parts after adjustments have been made.—*May 16th*, 1929.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

TO-DAY AND SATURDAY, JUNE 22ND.

INSTITUTION OF ELECTRICAL ENGINEERS.—France. Summer meeting. For programme see page 331, March 22nd, 1929.

TUESDAY TO FRIDAY, JUNE 25TH TO 28TH.

INSTITUTION OF MECHANICAL ENGINEERS.—Manchester. Summer meeting. For programme see page 302, March 15th, 1929.

TUESDAY, JULY 2ND.

INSTITUTION OF ELECTRICAL ENGINEERS: SOUTH MIDLAND CENTRE.—Summer meeting. Visit to the Avonmouth Docks. Assemble main booking hall, G.W.R., Snow Hill, Birmingham. 11 a.m.

TUESDAY TO THURSDAY, JULY 2ND TO 4TH.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.—Bolbec Hall, Newcastle-upon-Tyne. Summer meeting in Newcastle-upon-Tyne, jointly with the Institution of Engineers and Shipbuilders in Scotland. "The Story of Safety at Sea," by Sir Westcott S. Abell; "Developments in the Uses of Electricity," by Mr. R. P. Sloan; "The Applications of Monel Metal in Engineering and Shipbuilding," by Mr. John Ireland; "Some Notes on Damage to Ships," by Mr. J. L. Adam.

TUESDAY TO FRIDAY, JULY 2ND TO 5TH.

BRITISH WATERWORKS ASSOCIATION.—Portsmouth. For programme see page 447, April 19th, 1929.

THURSDAY AND FRIDAY, JULY 4TH AND 5TH.

INDUSTRIAL WELFARE SOCIETY.—Eighth annual conference of Editors of Works Magazines at Norwich.

FRIDAY, JULY 5TH.

INSTITUTION OF CIVIL ENGINEERS.—Birmingham and District Association. Visit to Liverpool to see the work in connection with the Mersey Tunnel. Leave New-street Station at 8.30 a.m.

OVERHEAD LINES ASSOCIATION.—Visit to the Mid-Cheshire Electricity Supply Company. The visit will start at 12.15 p.m. at Winsford (Gravel) Station (L.M. and S.).

SATURDAY, JULY 6TH.

PHYSICAL SOCIETY.—Visit to Birmingham. The following programme has been provisionally arranged:—Leave Paddington 9.10 a.m., arrive Leamington 10.44 a.m. On arrival at Leamington the party will drive by motor omnibus, provided by the University, to Birmingham *vid* Warwick. At Warwick a stop will be made to enable members to inspect Warwick Castle and other places of historic interest. Lunch will be taken at the University Refectory in the Edgbaston Buildings about 1.30 p.m., and thereafter the meeting will be held and the University Science Buildings will be open to inspection.

TUESDAY TO SATURDAY, JULY 9TH TO 13TH.

ROYAL AGRICULTURAL SOCIETY OF ENGLAND.—Royal Show at Harrogate.

WEDNESDAY TO FRIDAY, JULY 10TH TO 12TH.

ELECTRICAL ASSOCIATION FOR WOMEN.—Fourth Annual Conference at the North-East Coast Exhibition, Newcastle-on-Tyne.

TUESDAY TO SATURDAY, JULY 16TH TO 27TH.

AIRCRAFT EXHIBITION.—Olympia. Seventh International Aircraft Exhibition.

TUESDAY TO THURSDAY, JULY 23RD TO 25TH.

NEWCOMEN SOCIETY.—Summer meeting at Dartmouth, Devon. For programme see page 434, April 19th, 1929.

SATURDAY TO TUESDAY, AUGUST 3RD TO 13TH.

INSTITUTION OF ELECTRICAL ENGINEERS: LONDON STUDENTS' SECTION.—Summer Tour, 1929. The Students' Section summer tour will be held this year in Paris and Northern France.

CONTRACTS.

THE STANTON IRONWORKS COMPANY, Ltd., near Nottingham, has received the following orders for cast iron pipes for delivery to South America:—(*a*) For some forty miles for the Monte Video Water Supply, and (*b*) for ten miles for Rosario Water Supply, the pipes in both cases being chiefly in large diameters.

J. W. BROOKE AND CO., Ltd., of Lowestoft, have received from the Brazilian Government an order to supply (*a*) thirty 30ft. fast launches, having a beam of 6ft. and capable of 20 miles per hour, with Brooke "Hundred" six-cylinder motors; and (*b*) three 44ft. twin-screw sea-going craft, which are to be fitted with two Brooke "Hundred" six-cylinder machinery, giving a speed of 18 miles per hour.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

JOHN DAVIS AND SON (DERBY), Ltd., of All Saints Works, Derby, have just placed an order for extensions to their offices and garages, having quite recently considerably extended their works.

THE Institution of Production Engineers asks us to announce that it has acquired new headquarters in London at 48, Rupert-street, W. 1. Mr. Richard Hazleton has been appointed general secretary to the Institution.

SUBMARINE SIGNAL CORPORATION (BRITISH AGENCY) asks us to announce that, as from June 24th, it is transferring its offices from Friars House, New Broad-street, London, E.C. 2, to 9, Victoria-street, London, S.W. 1.

GEORGE ELLISON, the chief office of whom is at Perry Barr, Birmingham, asks us to announce that the address of his Manchester office has been changed from 78, King-street to No. 1, Dickinson-street. The telephone number, City 5964 (2 lines), and telegraphic address, "Starters Manchester," are not altered.

THE CLEAN COAL COMPANY, Ltd., asks us to announce that the address of its offices, laboratories and experimental works has been changed from Southampton House, 317, High Holborn, London, W.C. 1, to Medway House, Horseferry-road, Westminster, London, S.W. 1. Telegraphic address: Elimash, Sowest, London; telephone: Victoria 6172 and 6173.

WE understand that we were wrongly informed as to the announcement, published, under this heading, in our issue of last week, that Mr. H. A. Howie, Borough Electrical Engineer of Walsall, had been appointed Borough Electrical Engineer of Torquay. The position of Borough Electrical Engineer and Manager of Torquay is still open.

TECHNOLOGY RESEARCH SCHOLARSHIPS.—Notice is given by the Manchester Municipal College of Technology that a limited number of Research Scholarships in Technology (each of a value not exceeding £100) will be awarded in July, 1929. These Scholarships are tenable during the academic year 1929–30 in the Manchester Municipal College of Technology (Faculty of Technology in the University of Manchester). Applications must be received on or before July 6th, 1929. Forms of application and all information may be obtained by written application to the Registrar of the College.

THE ROYAL AERONAUTICAL SOCIETY'S EXHIBITION.—The Royal Aeronautical Society is devoting a portion of the accommodation allotted to it at the International Aero Exhibition at Olympia to the exhibition of inventions relating to aeronautics which have not as yet reached the point of commercial development. All those interested should communicate with the Secretary of the Royal Aeronautical Society, 7, Albemarle-street, W. 1, as quickly as possible, and in any case not later than Saturday, June 29th, after which no entries can be considered. Devices should be of such a nature that they can be displayed on a counter—or floor—space not exceeding 8ft. square.

THE YARROW PULVERISED FUEL SYSTEM.—Reference has already been made in the columns of THE ENGINEER to the experimental work carried out by Yarrow and Co., Ltd., of Scotstoun, on the development of a pre-furnace and burner for the utilisation of powdered fuel in water-tube and cylindrical boilers. We are now able to state that, in order to test the merits of pulverised fuel in its Glasgow-Burma service of steamships, P. Henderson and Co., Ltd., of Glasgow, have arranged with Yarrow and Co., Ltd., to equip half the boiler installation on the steamer "Amarapoora" with the Yarrow type of pulverised fuel equipment. The "Atritor" type of pulveriser, made by Alfred Herbert and Co., Ltd., of Coventry, will be installed. The "Amarapoora" is a cargo steamer of about 8000 gross tons, with a length of 466ft. and a designed speed of about 14 knots. She was built and engined in 1920 by Denny Bros., Ltd., of Dumbarton, and is propelled by reciprocating steam engines of 4500 I.H.P. output, steam being raised in four cylindrical boilers designed to use either coal or oil fuel.

LOUGHBOROUGH COLLEGE: BRITISH EMPIRE SCHOLARSHIPS.—The entrance examinations for the award of British Empire Scholarships in the Faculty of Engineering, Loughborough College, Leicestershire, have now been completed and the awards made. The Scholarships are tenable at Loughborough for the full period of the Diploma Course, and the Governors of the College have approved the following awards for 1929:—(1) L. M. G. F. Cabral, Queen's College, Georgetown, British Guiana, South America; (2) S. W. Millward, The Grammar School, Cheltenham; (3) F. G. McDonald, the Technical High School, Johannesburg, South Africa; (4) T. D. Walshaw, Hurstpierpoint College, Sussex; (5) Paul Finucane, Lawrence Royal Military School, Sanawar, India; and (6) Horace I. Price, County School, Abertillery, South Wales. These Scholarships are open to all British subjects resident in any part of the Empire and are of the value of £75 per annum. Applications were, we are informed, received from a large number of the public and secondary schools in England, South Africa, Rhodesia, Australia, British Guiana, India, and the Federated Malay States.

ROYAL SOCIETY OF ARTS, SIXTH ANNUAL COMPETITION OF INDUSTRIAL DESIGNS.—The entries for this year's competition have now been received, and although, until they have all been checked and classified, it it not possible to state the exact number of designs entered, it is quite evident that the interest in the competition is well maintained, and that there will be a further increase this year in the number of competitors and designs. Last year there were 1024 competitors and 3126 mounts of designs. So far as can be ascertained at present the numbers this year will be 1240 competitors and about 3500 designs. There is a large number of entries for textile designs, which show an increase of about 300 on last year's figures—959. As the number of textile designs entered in 1927 was 487 the increase in the last two years is noteworthy. There is an innovation this year in the pottery and glass section, as 140 actual specimens of fired pottery have been entered. The judging of the designs and awarding of the various scholarships and prizes will take place in July, and the accepted designs will be on view at the Imperial Institute, South Kensington, S.W., from August 3rd to September 1st, Sundays included.